

# LTC2980-24

## 24-Channel Power Supply System Featuring the LTC2980-24 Power System Manager

### DESCRIPTION

The DC3097A-KIT is a demonstration system for the [LTC®2980-24](#) for the 24-channel I<sup>2</sup>C/SMBus/PMBus Power System Manager (PSM) with EEPROM. It consists of 4 circuit boards, namely one DC3094A board and three DC1361B boards. The LTC2980-24 monitors and controls 24 power supply rails which are provided by three DC1361B power supply boards that plug into the DC3094A. The system demonstrates the ability of the LTC2980-24 to sequence, trim, margin, supervise, monitor, and log faults for the twenty-four power supplies. Together these four boards form a sophisticated, 24-channel, digitally programmable and digitally managed power supply system.

The board set contains twenty-four independent power supply rails, by having the three DC1361B boards. All 24 rails are based on LTM4603 DC/DC  $\mu$ Module® switching regulators. The DC1361B board is pre-configured with output voltages ranging from 0.8V to 3.3V. The power supply channels may be reconfigured to different output voltages by changing the feedback resistors. The LTC2980-24 can be configured to monitor current on odd numbered channels. The DC1361B board has been designed to allow the user to enable this feature on Channel 7 (see Measuring Current). In this configuration, Channel 7 measures the current on Channel 6's 1V output.

The LTpowerPlay® graphical user interface (GUI) supports this demonstration system and enables complete control of all the features of the LTC2980-24. Together, the LTpowerPlay software and DC3094A hardware system create a powerful development environment for designing and testing configuration settings of the LTC2980-24. LTpowerPlay stores these settings in the LTC2980-24 internal EEPROM or in a project file. The software displays all the configuration settings and real time measurements from the Power System Management IC. Telemetry allows easy access and decoding of the fault log created by the LTC2980-24. The board comes pre-programmed with the EEPROM values appropriate for the twenty-four power supply rails. Just plug and play!

Order preprogrammed devices from Analog Devices Express (ADX) using LTpowerPlay:

[www.analog.com/programming](http://www.analog.com/programming)

The DC3097A-KIT demo boards can be powered by an external power supply, such as a +12VDC supply. Communication with the software is provided through the DC1613 USB-to-I<sup>2</sup>C/SMBus/PMBus Controller. The following items are required:

- +12VDC Power Supply
- USB-to-I<sup>2</sup>C/SMBus/PMBus Controller (DC1613)
- LTpowerPlay Software

#### LTC2980-24 Features

- Sequence, Trim, Margin, and Supervise Twenty-Four Power Supplies
- Manage Faults, Monitor Telemetry, Create Fault Logs
- PMBus Compliant Command Set
- Supported by LTpowerPlay GUI
- Margin or Trim Supplies to 0.15% Accuracy
- Fast OV/UV Supervisors per Channel
- Multi-Channel Fault Management
- Automatic Fault Logging to Internal EEPROM
- Operates Autonomously without Additional Software
- Telemetry Reads Back  $V_{IN}$ ,  $V_{OUT}$ , and Temperature
- 24-Channel Time-Based Output Sequencer
- I<sup>2</sup>C/SMBus Serial Interface
- Powered from 4.5V to 15V
- 210-Pin BGA Package

**Design files for this circuit board are available.**

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# DEMO MANUAL

## DC3097A-KIT

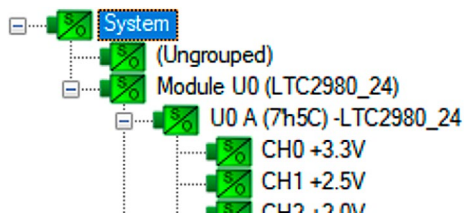
### PERFORMANCE SUMMARY Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$V_{PWR}$ Supply Input Operating Range		4.5		15	V
$V_{DD33}$ Supply Input Operating Range		3.13		3.47	V
ADC $V_{SENSE}$ Total Unadjusted Error	$1\text{V} \leq V_{SENSE} \leq 6\text{V}$ $0\text{V} \leq V_{SENSE} \leq 1\text{V}$		$\pm 0.15$ $\pm 1.5$		% mV
ADC Voltage Sense Input Range		-0.1		6	V
ADC Voltage Sensing Resolution	$0\text{V} \leq V_{IN\_ADC} \leq 6\text{V}$		122		$\mu\text{V}/\text{LSB}$
ADC Current Sensing Resolution (odd numbered channels only)	$0\text{mV} \leq  V_{IN\_ADC}  < 16\text{mV}$ $16\text{mV} \leq  V_{IN\_ADC}  < 32\text{mV}$ $32\text{mV} \leq  V_{IN\_ADC}  < 63.9\text{mV}$ $63.9\text{mV} \leq  V_{IN\_ADC}  < 127.9\text{mV}$ $127.9\text{mV} \leq  V_{IN\_ADC} $		15.625 31.25 62.5 125 250		$\mu\text{V}/\text{LSB}$ $\mu\text{V}/\text{LSB}$ $\mu\text{V}/\text{LSB}$ $\mu\text{V}/\text{LSB}$ $\mu\text{V}/\text{LSB}$
DAC Resolution			10		bits
DAC Full-Scale Output Voltage	Buffer Gain Setting 0 Buffer Gain Setting 1		1.38 2.65		V V
Int Temperature Sensor TUE			$\pm 1$		$^\circ\text{C}$
Voltage Supervisor Input Voltage Range (Programmable)	$V_{SENSE[n]}$ Low Resolution High Resolution	0 0		6 3.8	V V
Voltage Supervisor Sensing Resolution	0V to 6V Range (Lores) 0V to 3.8V Range (Hires)		8 4		mV/LSB mV/LSB
Voltage Supervisor Total Unadjusted Error (TUE)	$2\text{V} < V_{IN\_VS} < 6\text{V}$ , Low Resolution Mode $1.5\text{V} < V_{IN\_VS} < 2\text{V}$ , High Resolution Mode $0.8\text{V} < V_{IN\_VS} < 1.5\text{V}$ , High Resolution Mode		$\pm 1.25$ $\pm 1.0$ $\pm 1.5$		% % %
I <sup>2</sup> C Serial Clock Frequency		10		400	kHz

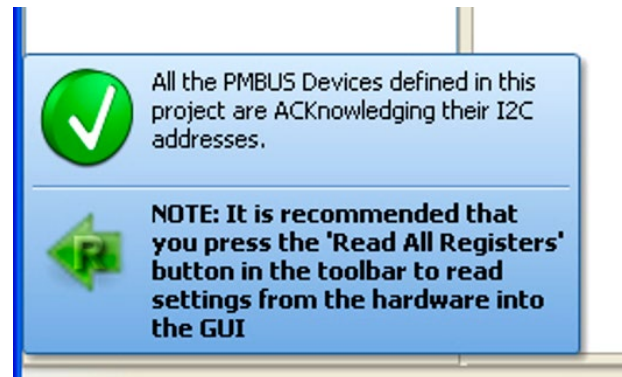
## QUICK START PROCEDURE

The following procedure describes how to set up a DC3097A demo system.

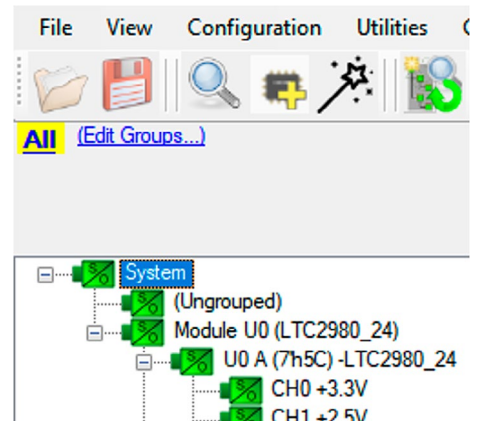
1. Download and install the LTpowerPlay GUI:  
[www.analog.com/ltpowerplay](http://www.analog.com/ltpowerplay)
2. Remove the board from the ESD protective bag and place it on a level surface. Connect the DC1613 I<sup>2</sup>C/SMBus/PMBus Controller to the DC3094A board using the 12-pin ribbon cable
3. Confirm that the CTRL switches are set to the OFF position
4. Plug the USB-to-I<sup>2</sup>C/SMBus/PMBus Controller into a USB port on your PC. The DC1613's ribbon cable will power up the LTC2980-24 device, as indicated by the illuminated green LED next to the LTC2980-24.
5. Connect a +12VDC power supply with >1.5A capacity to the VIN input terminals of one of the DC1361B boards. Power to the other two DC1361B boards is provided by the DC3094A. Set the CTRL0 switch to the RUN position. The outputs of the two DC1361B boards (CH0 - CH15) will power up and the green LEDs will illuminate. Set CTRL1 switch to RUN to enable the remaining 8 channels (CH16 - CH23).
6. Launch the LTpowerPlay GUI.
  - a. The GUI automatically identifies the DC3094A and builds a system tree for each I<sup>2</sup>C device. The system tree on the left-hand side will look like this:



- b. A green message box will be displayed momentarily in the lower left-hand corner confirming that the DC3094A is communicating.



- c. You may make configuration changes. When you update registers in the GUI by using either function key F12 to write an individual register or use the Write All icon to write all registers, you may need these settings for future use. Save the demo board configuration to a (\*.proj) file by clicking the "Save" icon. This creates a backup file on your C: drive. Name it whatever you like.



If you need to load the original board default configuration, select the GUI menu pulldown item DEMO > DC3094A\_Defaults. This writes the board defaults into the RAM and NVM of the LTC2980-24 device.

7. The LTC2980-24 is configured to use both CTRL switches to sequence on/off the twenty-four channels. Slide the switches to RUN to enable all channels, OFF to disable all channels.

### QUICK START PROCEDURE

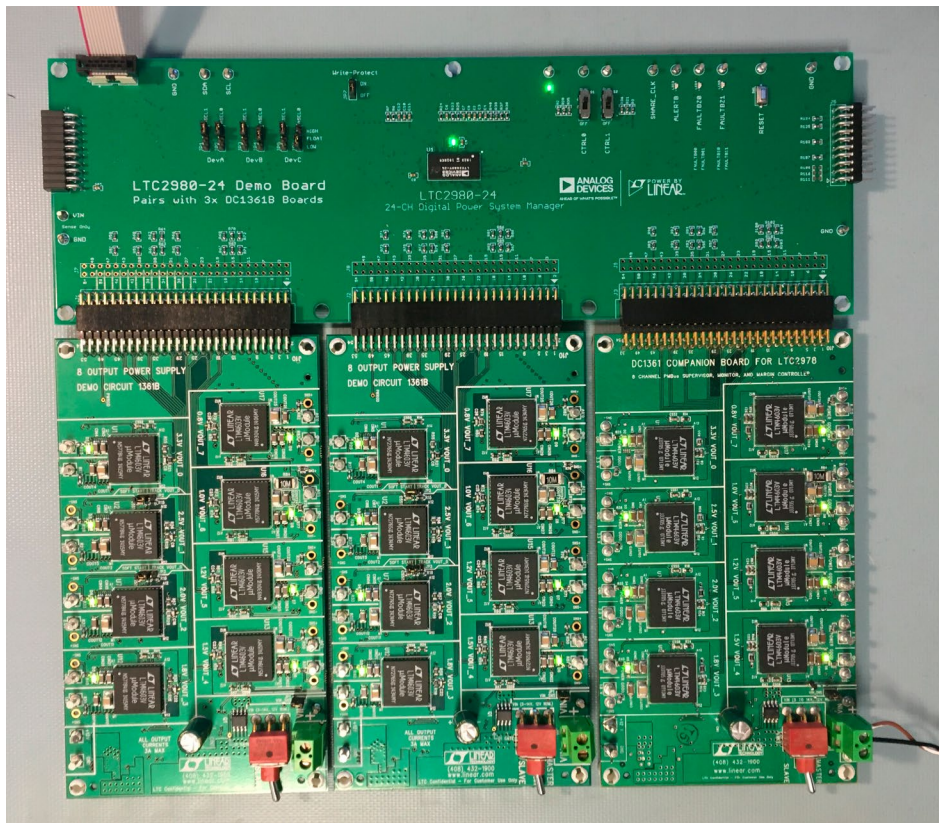


Figure 1. DC3097A Kit Comprised of the DC3094 and DC1361B Boards

#### Loading a Configuration (\*.proj) File with the GUI

To load a previously saved proj file:

1. In the upper left-hand corner of the GUI, File > Open > browse to your \*.proj file. This will load the file into the GUI.
2. Click on the Go Online icon,



then click on the PC→RAM icon to write all registers. This loads the configuration into the working RAM of the LTC2980-24 device.



3. To store the configuration to NVM (EEPROM), click on the RAM→NVM icon.



## DEMO SYSTEM SPECIFICATIONS

### DC1361B Summary (Eight LTM4603)

	NOMINAL UNTRIMMED $V_{OUT}$	RESISTOR THAT SETS UNTRIMMED $V_{OUT}$	$R_{DAC}$	MARGIN RANGE
CH0	+3.325V $\pm$ 1.5%	R21	R55	$\pm$ 12%
CH1	+2.497V $\pm$ 1.5%	R26	R56	$\pm$ 12%
CH2	+1.989V $\pm$ 1%	R29	R57	$\pm$ 12%
CH3	+1.804V $\pm$ 1%	R38	R58	$\pm$ 12%
CH4	+1.502V $\pm$ 1%	R48	R59	$\pm$ 12%
CH5	+1.200V $\pm$ 1%	R67	R68	$\pm$ 12%
CH6	+0.999V $\pm$ 1%	R73	R74	$\pm$ 12%
CH7	+0.799V $\pm$ 1%	R79	R80	$\pm$ 12%

#### Notes:

- Load currents <3A on each output is recommended.
- Max  $V_{IN}$  current into J11 (+12V) should be limited to 4A.
- Each LTM4603 has an internal topside feedback resistor 60.4k.
- Output voltages can be margined by  $\pm$ 12% or more from nominal with the default resistor values. The output voltages and margin range can be easily changed. See section Changing DC1361B Nominal Output Voltages. Use the LTC2980-24 Resistor Selection Tool which is accessed from LTpowerPlay.

### What this Demo System Can Do

- Prototype your system by modifying: nominal output voltages, range and resolution of margining, sequencing, and OV/UV limits.
- Create your own configuration: store in the LTC2980-24 EEPROM or save to a project file. Order pre-programmed parts.
- Test fault scenarios. Short outputs to ground, and observe system response and faults.

### Demo System Hardware

Hardware required:

1. 1x DC3094A
2. 3x DC1361B
3. PC + USB cable
4. 12V, >1.5A power supply
5. USB to I<sup>2</sup>C/SMBus/PMBus Controller

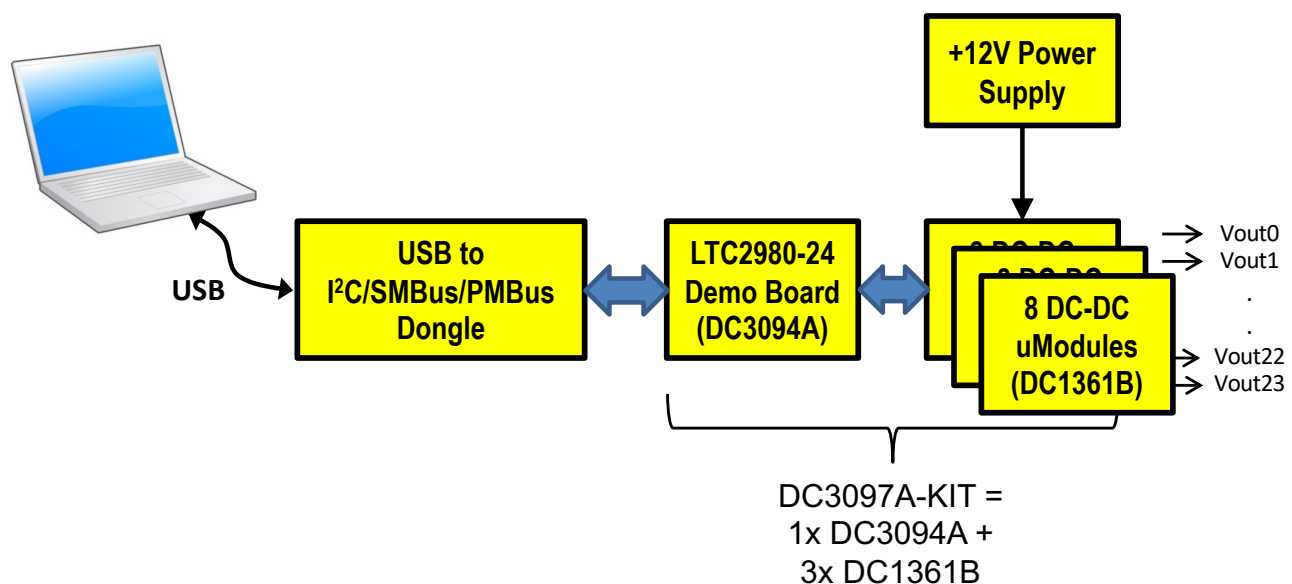


Figure 2. DC3097A Demo Setup



### DOWNLOAD GUI TO YOUR PC

#### LTpowerPlay GUI Software

LTpowerPlay is a powerful Windows-based development environment that supports Analog Devices Power System Management ICs with EEPROM, including the LTC2980-24 24-Channel Power System Manager. The software supports a variety of different tasks. You can use LTpowerPlay to evaluate Analog Devices ICs by connecting to a demo board system. LTpowerPlay features an offline mode to build a multi-chip configuration file for later use with hardware. LTpowerPlay provides unprecedented system level diagnostic and debug features. It becomes a valuable diagnostic tool during board bring-up to program or tweak the power management scheme in

a system or to diagnose power issues when bringing up rails. LTpowerPlay utilizes the DC1613 I<sup>2</sup>C/SMBus/PMBus Controller to communicate with one of many potential targets, including the DC3097A demo system or a customer board. The software also provides an automatic update feature to keep the software current with the latest set of device drivers and documentation. Download the software from:

[www.analog.com/ltpowerplay](http://www.analog.com/ltpowerplay)

Select Help, View Online Help from the LTpowerPlay menu to access technical documents.

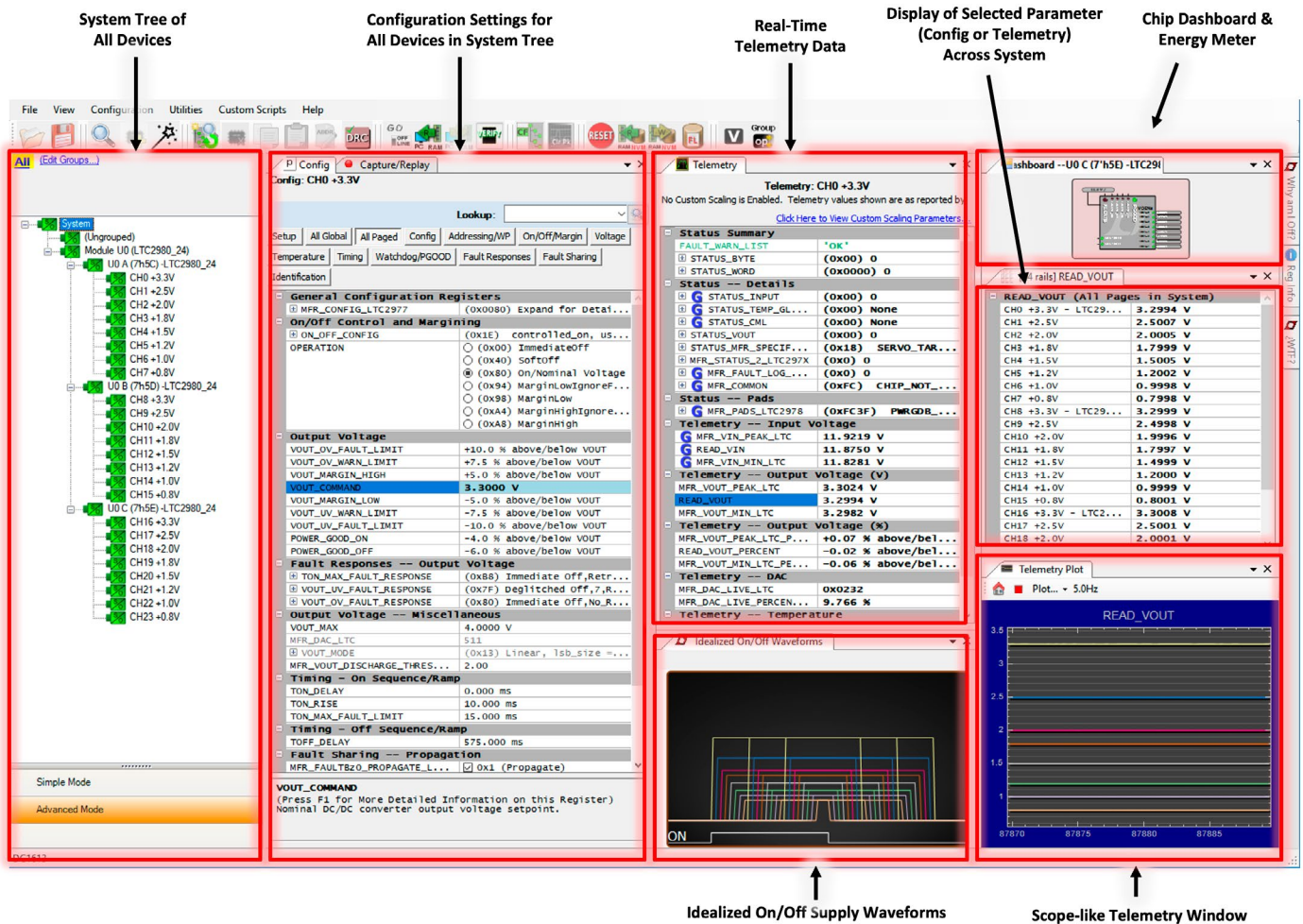


Figure 3. Screenshot of the LTpowerPlay GUI

## DC3097A KIT DETAILS

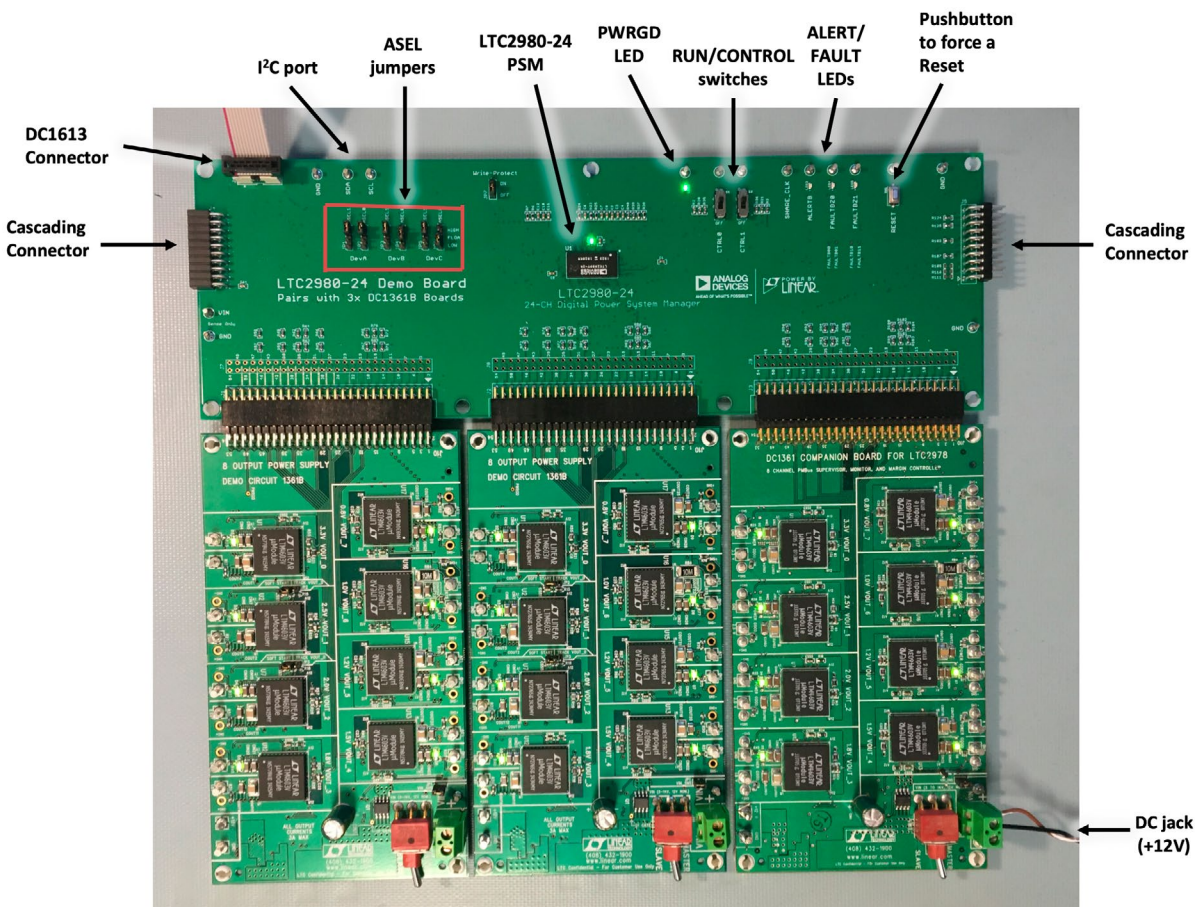


Figure 4. DC3097A-KIT Details

### POWERING THE BOARD SET

A 12V power supply must power one of the DC1361B boards. The LTC2980-24 PSM device obtains 12V input power from the DC1361B board. The supply must be capable of delivering >1.5A. If channels are loaded, the input current may exceed 2A. Power to the LTC2980-24 device is automatically switched from either the DC1613's 3.3V power or DC jack power if  $V_{IN}$  is applied.

### DC3094A LEDs

The green LED labeled  $V_{DD33}$  illuminates when the LTC2980-24 is powered from either the USB controller or the external  $V_{IN}$  power. The red LEDs on ALERTB and FAULTB indicate a warning or fault has occurred. A green PWRGD LED will illuminate when all channels outputs have been measured by the LTC2980-24 ADC readings.

Each channel on the DC1361B has its own green LED which indicates that the channel is enabled.

### SELECTING ADDRESSES

The LTC2980-24 integrates three LTC2977 devices to form a 24-channel PSM device. When the I<sup>2</sup>C/PMBus is enumerated, three separate devices will appear. Each LTC2977 device needs its own address. Best practices would use a common base address and use different offsets for each LTC2977. Jumpers are provided to select the offsets.

### RESETTING LTC2980-24

To reset the LTC2980-24 and reload the EEPROM contents into operating memory (RAM), press the pushbutton switch SW1 labeled RESET.

### DC3097A KIT DETAILS

#### PRE-LOAD THE OUTPUTS

Each of the outputs has pre-load resistors that provide ~100mA of load current. This ensures that the output voltage decays to GND quickly when the channel is disabled. This is useful when sequencing off then on quickly.

#### SEQUENCING CHANNELS

By default, twelve channels are controlled by the CTRL0 switch and the other twelve channels are controlled by the CTRL1 switch. You may change the LTC2980-24 configuration to allow channels to respond to either switch.

To demonstrate time-based sequencing, you can use either the CTRL0 or CTRL1 switch. The LTC2980-24 device is pre-configured with different TON\_DELAY values for each channel. The TON\_DELAY parameter is applied to each of the channels relative to the CONTROL pin or Group operation command to turn all channels 'on'. The same applies to TOFF\_DELAY values. When the CONTROL switch is set to the OFF position, all rails will power down sequentially based on the device's TOFF\_DELAY values.

Each channel has an LED that visually indicates if the channel has power. When the CONTROL pin is switched on and off, you will observe the relative on/off timing of the twenty-four channels. The timings are intentionally skewed to show the rails ramp times more clearly.

TON_DELAY (All Pages in System)	
CH0 +3.3V - LTC2980_24	0.000 ms
CH1 +2.5V	25.000 ms
CH2 +2.0V	50.000 ms
CH3 +1.8V	75.000 ms
CH4 +1.5V	100.000 ms
CH5 +1.2V	125.000 ms
CH6 +1.0V	150.000 ms

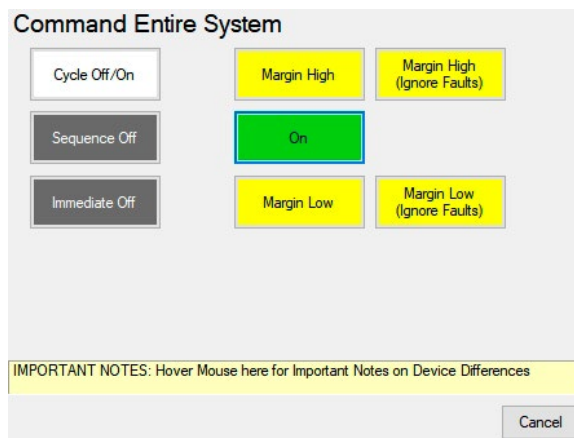
TOFF_DELAY (All Pages in System)	
CH0 +3.3V - LTC2980_24	575.000 ms
CH1 +2.5V	550.000 ms
CH2 +2.0V	525.000 ms
CH3 +1.8V	500.000 ms
CH4 +1.5V	475.000 ms
CH5 +1.2V	450.000 ms
CH6 +1.0V	425.000 ms

Figure 5. TON\_DELAY and TOFF\_DELAY Settings

The TON\_DELAY and TOFF\_DELAY values extend to 13.1 seconds, providing a wide range for sequencing on and off the power supply rails.

#### MARGIN ALL RAILS

The LTC2980-24 power system manager not only monitors output voltages but can margin the outputs either high or low. Margining is the operation that moves a rail up or down for testing purposes. It allows a system to be fully characterized over supply limits without the use of external hardware or resources. The GUI provides an easy way to margin all rails high or all low by clicking one of four buttons.



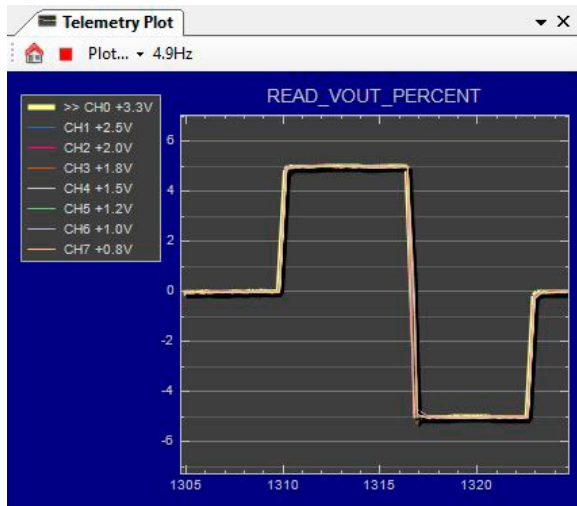
To invoke the margining dialog, click the GroupOp icon in the toolbar. The buttons labeled ignore faults will margin without creating a fault even if the fault limits are exceeded.



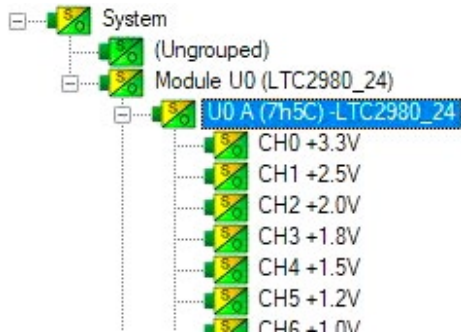
A look at the telemetry window shows the effect of the margin high or margin low operation. This screen shot is a telemetry plot of READ\_VOUT\_PERCENT showing all rails going from nominal set-points to margin high, margin low, and back to nominal voltages.



### DC3097A KIT DETAILS



The LTC2980-24 has a multiplexed ADC that is used to provide voltage, current, and temperature readback values. The telemetry plot in the GUI is similar to a multi-channel oscilloscope which is capable of displaying any parameter that is displayed in the telemetry window. Due to the nature of a multiplexed ADC converter, it has an associated ADC loop time of approximately 90ms.

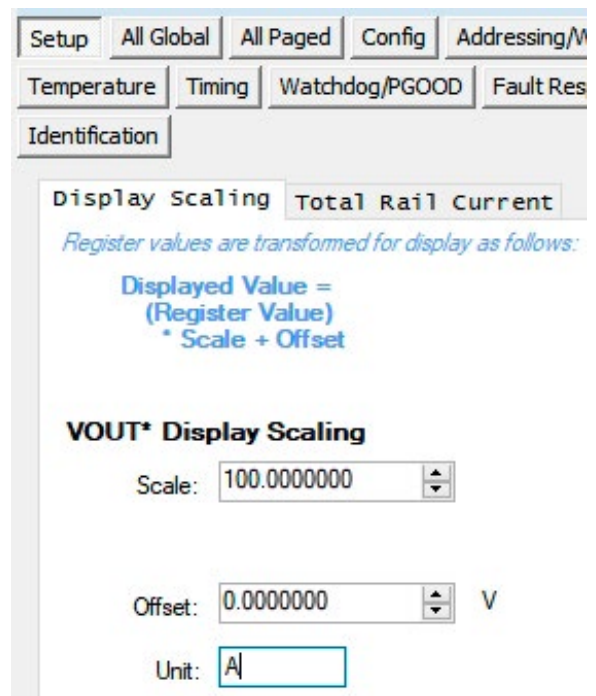


### MEASURING CURRENT

It is possible for the LTC2980-24 to measure the current on Channel 6 by configuring Channel 7 to hi-res ADC mode. The same can be done to Channel 14/15 and 22/23. On the DC1361B, hardware changes must be made (soldering and desoldering). Remove R88, R89 and move them to R86, R87. Also remove the preload resistor R75 (top side) on the DC1361B to measure only the current going out of the board.

One simple checkbox in the GUI sets up Channel 7 to measure current. In the MFR\_CONFIG\_LTC2977 register check the box that says adc\_hires. Apply a load between

the big turrets 1.0V and GND on VOUT\_6 and read the voltage across the 10mΩ current sense resistor by viewing the READ\_VOUT register on Channel 7 in the GUI. The register shows the value in mV, and can be changed to mA by changing the Units from V to A under the Setup tab. The load current will now read in milliamps in the READ\_VOUT register. The Scale factor is 100 for a 10mΩ sense resistor. Minor adjustments may be made by changing the Scale and/or Offset to match the known load currents that you apply to your board.



NOTE: The load current on Channel 6 must be <2A, otherwise the  $V_{SENSE}$  differential voltage will saturate the reading.

### CREATING A FAULT

The user may force a UV fault on a channel by shorting an output to GND. This demonstrates the demo board's ability to detect it and respond according to the configuration. Any output may be shorted to GND by shorting with a wire or coin at the turrets. When faulted, all channels power down immediately and the GUI's system tree indicates the color red for the Status portion of that channel. You should see all outputs power off, the fault LED momentarily illuminate, the alert LED illuminate continuously, and

### DC3097A KIT DETAILS

all rails sequence back on after a retry period. You may also apply the short indefinitely to demonstrate the fault behavior and retry timing.

#### CLEARING A FAULT

To clear a fault, the user can click the CF icon in the GUI or simply push the RESET pushbutton (SW1) on the DC3094A demo board. In both cases, the red (+) on the CF icon and alert LED on the board are both cleared. Notice that all rails are automatically re-enabled after a programmable retry period. A dialog box may pop up after clicking the Clear Faults (CF) icon. If a fault log is present, a dialog will ask if you would like to clear the fault log as well as clear system faults. After clearing faults, the system tree will return to green and fault logs re-armed. For further information, see the Working with the Fault Log section.



#### WHY AM I OFF? TOOL

Use the Why am I Off tool in the LTpowerPlay GUI to diagnose the cause for a power supply channel being in an off state. The tool is located in the top right corner of the GUI, above the Register Information tab. Hover your cursor over the tab to show the tool.

First select an output channel in the system tree. The tool collects various status information and provides a diagnosis.

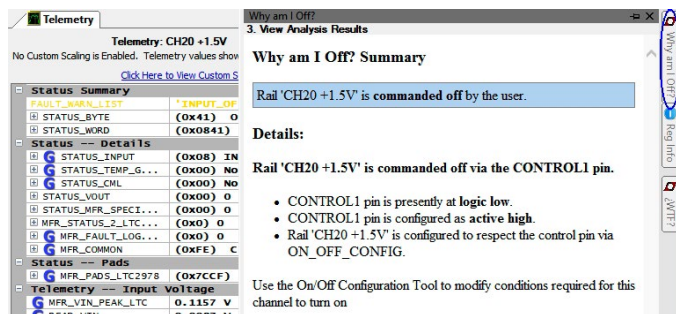


Figure 6. Why Am I Off Tool in the LTpowerPlay GUI

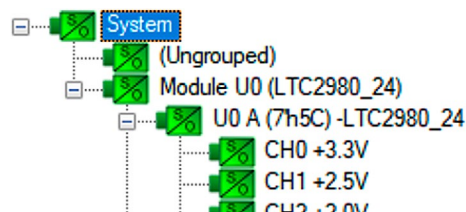
### ADVANCED DEMO BOARD OPERATIONS

#### What Is a Fault Log?

A fault log is a non-volatile record of the power system leading up to the time of fault. Telemetry data is continuously updated in a circular RAM buffer in the LTC2980-24. When a fault occurs, the contents of the RAM buffer are automatically written to NVM. The most recent monitored values (uptime, voltage, current, temperature) provide additional context preceding the fault. It is a powerful diagnostic feature of the LTC2980-24 on the DC3094A demo board.

#### Create a Fault Log

To create a fault log, check that the *fault\_log\_enable* bit is set in the MFR\_CONFIG\_ALL register. Then, create a fault, as described in the section Creating A Fault. Select the appropriate device in the system tree by clicking on the appropriate LTC2980-24 chip. We are ready to work with the fault log.



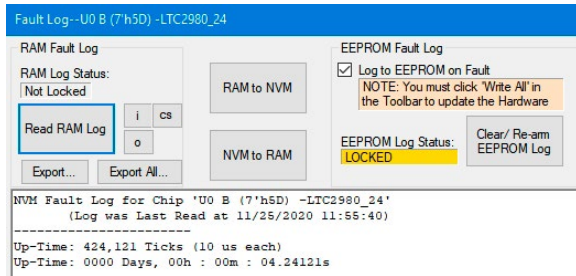
#### Working with the Fault Log

Once a fault has occurred, the Fault Log (FL) icon will show a red (+) sign on it, indicating that the GUI has detected a fault log in the device.

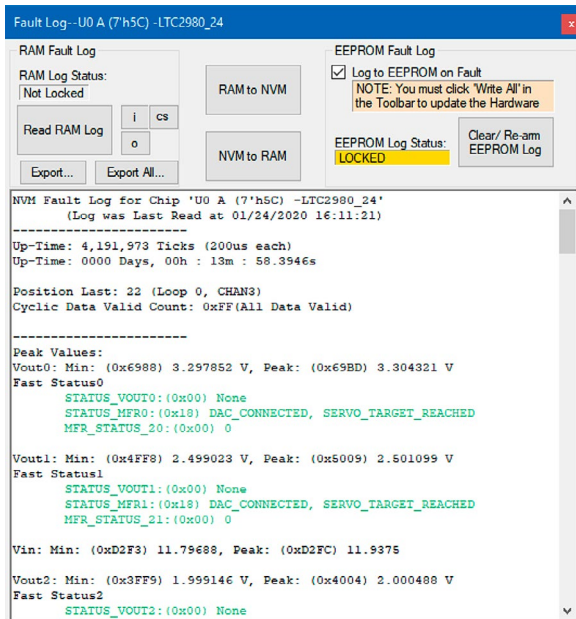


Clicking the icon will bring up a dialog box. Note that it is a context sensitive icon. Be sure to select the desired device in the system tree. Notice that the EEPROM log is locked. The log will not change until it is cleared by the user.

## DC3097A KIT DETAILS



It is a 2-step process to read the fault log. First click the NVM to RAM button. At this point the RAM Log is locked. Click the Read NVM Log button. The fault log data will appear in the text box below.



The log contains timestamp, uptime, channel voltage readings, an input voltage reading, an on-chip temperature reading, etc. There will be a number of loops; each loop contains data obtained in one ADC loop time with the most recent ADC loop data on top and the oldest data at the bottom of the log. The uptime indicates, at the time of fault, the amount of time the device had been powered up or time since the previous reset.

In this case, the fault log will show that channel U0:0 faulted due to a VOUT\_UV\_FAULT condition. On the pre-

vious telemetry loop, the channel voltage reading was a nominal value (+12V). You can save the fault log to a file (.rtf) by clicking the Export button.

To clear the fault log, click the Clear/Rearm EEPROM Log button. This allows the selected device to be ready for a new fault event. To clear all faults, click the Clear Faults (CF) icon.

### Fault Sharing Setup in the GUI

Fault sharing provides a means of propagating a fault detected by a power manager to other power managers via FAULT pins. Use the Fault Sharing Setup Tool to configure the fault sharing in the GUI. Select the LTC2980-24 in the system tree. Go to Utilities > Fault Sharing Diagram. For more details on this topic, please refer to the Fault Management section in the data sheet.

The fault sharing dialog will appear as shown in Figure 7. All Response and all Propagate switches are closed by default. In this configuration, a fault on a channel will shut down not only the faulted channel but all other channels since the Propagate switches are closed.

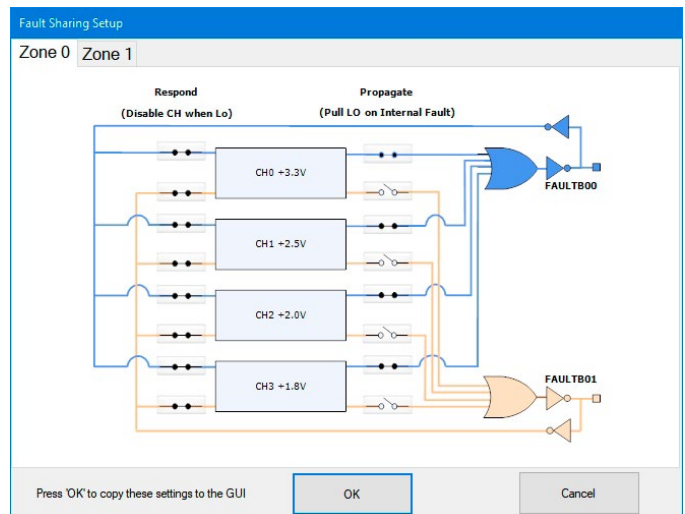


Figure 7. Fault Sharing Utility in LTpowerPlay GUI

### DC3097A KIT DETAILS

There are two types of actions to fault conditions: How a channel responds to another channel's fault and whether a particular channel propagates its fault to other channels. FAULT pins are bidirectional, meaning the device may drive its fault pin low (output) or may respond to the fault pin when another device drives it low (input). By default, the LTC2980-24 is configured to shut down all channels if the FAULT pin is low and to propagate its own fault to the other channels by driving both FAULT pins low. The FAULT pins are tied together, which effectively creates one fault line. You can think of the Response switches as *shut this channel down* when another channel faults, and the Propagate switches as *drive the fault pin* to broadcast to other channels that this channel faulted.

#### Fault Configuration Example

Let's explore two different examples. Suppose we do not want channel CH2 (+2.0V rail) to propagate its fault to the other channels when it faults. And suppose we do not want channel CH3 (+1.8V rail) to shut down in response to another channel's fault. We can configure the switches as shown in Figure 8. Simply click the switches to open/close. Click OK to close the dialog box. Click the PC→RAM icon to write the changes to the LTC2980-24.

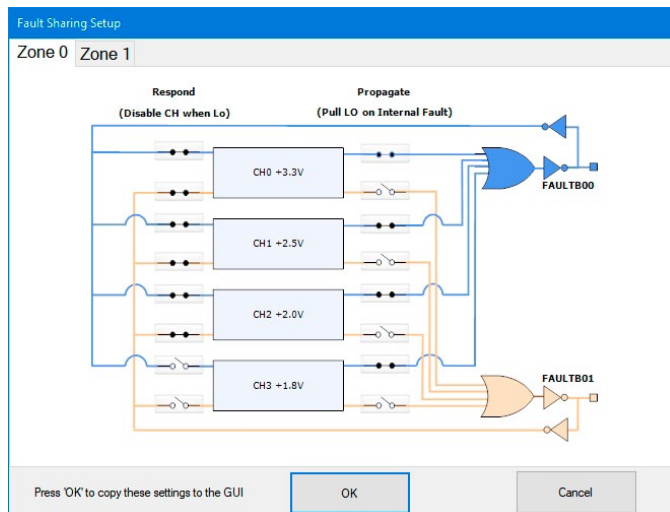
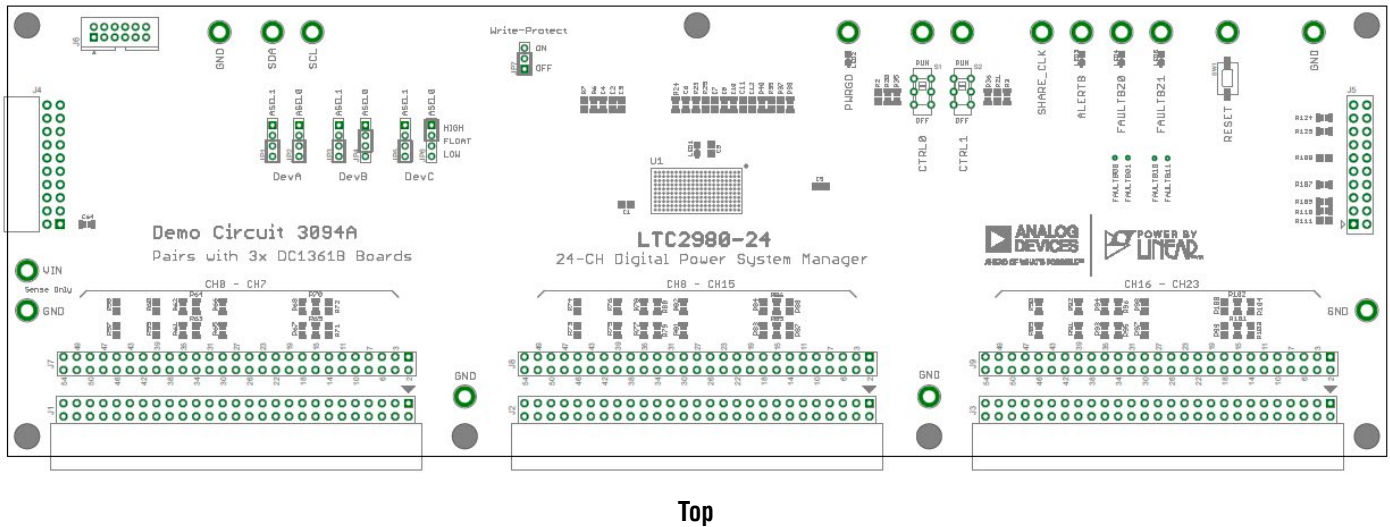


Figure 8. Updated Fault Sharing Configuration

We can now create a fault on CH2 by shorting the output turret to GND. You will notice that CH2 shuts off but the other channels remain powered up because its fault is not propagated to the other channels. After the retry period, the channel will power back up. We can now observe the effect of changing the response setting on CH3. If you short the FAULTZ0 turret to ground, notice that all rails shut down except CH3. This is an example of a keep-alive channel that remains powered up independent of faults to other channels.



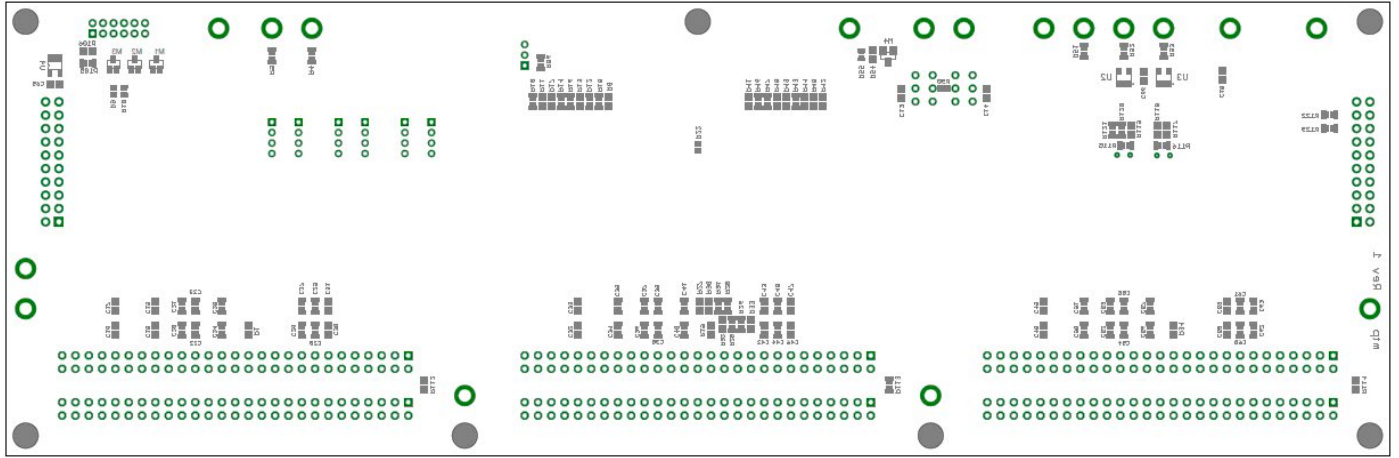
## DC3094A DETAILS



**Table 1. DC3094A: Default Jumper and Switch Configuration**

REFERENCE DESIGNATOR	SIGNAL NAME	USAGE	DEFAULT
JP1, JP2	ASEL0, ASEL1 for DevA	Sets the address offset for Device A.	LOW, LOW
JP3, JP4	ASEL0, ASEL1 for DevB	Sets the address offset for Device B.	FLOAT, LOW
JP5, JP6	ASEL0, ASEL1 for DevC	Sets the address offset for Device C.	HIGH, LOW
JP7	WP	Enables/Disables Write Protect for LTC2980-24 .	
S1	CTRL0	Switch used to enable/disable channels by pulling the CONTROL0 input pin high/low on LTC2980-24.	RUN
S2	CTRL1	Switch used to enable/disable channels by pulling the CONTROL1 input pin high/low on LTC2980-24.	RUN

### DC3094A DETAILS



Bottom

## GLOSSARY OF TERMS

The following list contain terms used throughout the document.

**Channel:** The collection of functions that monitor, supervise, and trim a given power supply rail.

**EEPROM:** Non-volatile memory (NVM) storage used to retain data after power is removed.

**Margin:** Term used typically in board level testing that increases/decreases the output voltage to look for sensitivity/marginality problems.

**Monitor:** The act of measuring voltage, current, and temperature readings.

**NVM:** Non-volatile memory, see EEPROM.

**OV:** Overvoltage, the result of a voltage comparison that a pin voltage is above a programmable threshold voltage.

**PMBus:** An industry standard power-management protocol with a fully defined command language that facilitates communication with power converters and other devices in a power system.

**Rail:** The final output voltage that the LTC2980-24 supervises.

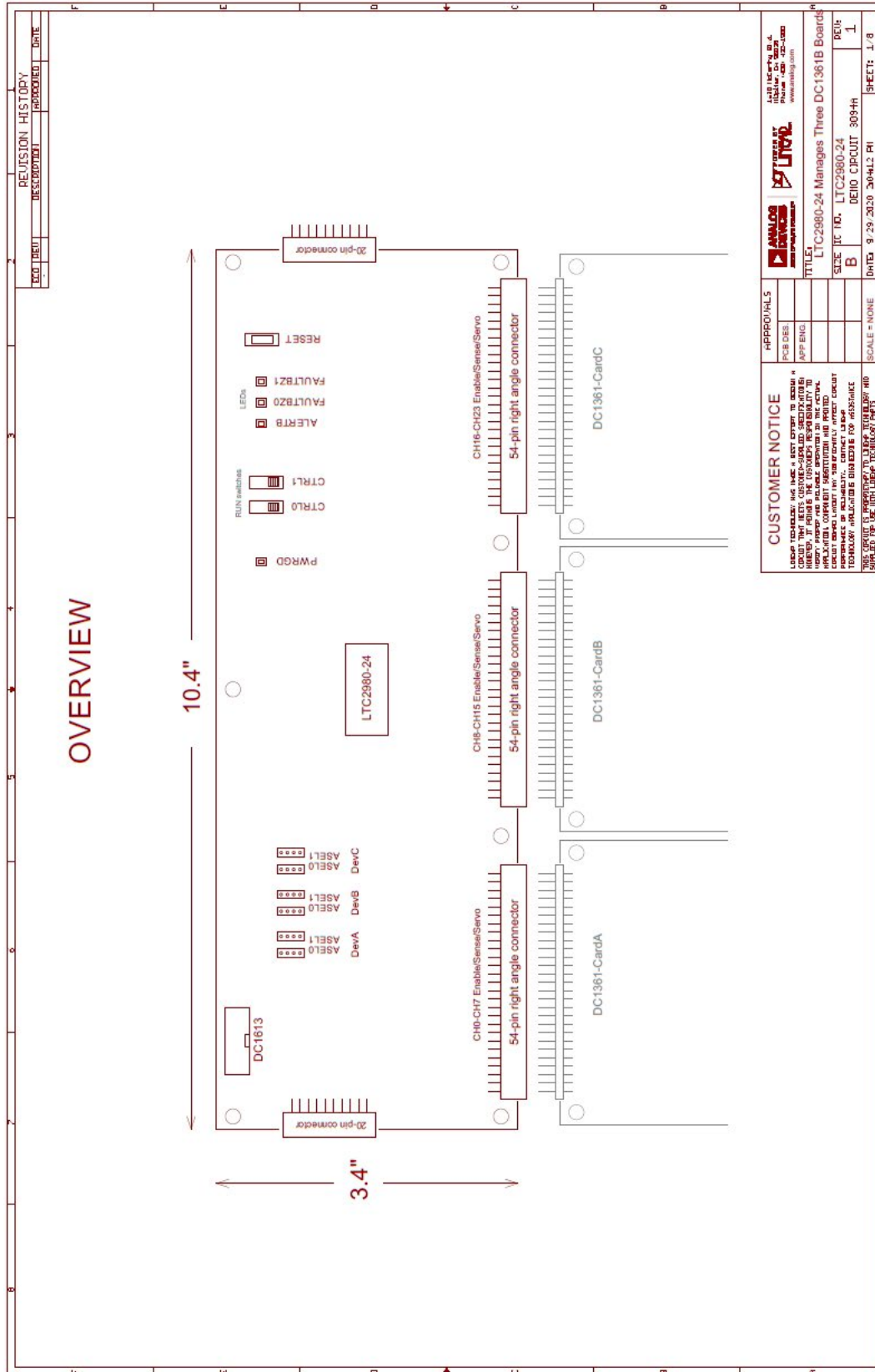
**Supervise:** The act of quickly responding (compared to a fault setting) to a voltage and current condition that is compared to pre-programmed values.

**Trim:** The act of adjusting the final output voltage. A servo loop is typically used to trim the voltage.

**UV:** Undervoltage, the result of a voltage comparison that a pin voltage is below a programmable threshold voltage.

# DEMO MANUAL DC3097A-KIT

## SCHEMATIC DIAGRAM



**CUSTOMER NOTICE**  
 LAYOUT TOOLBOX: USE ONLY A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SPECIFIED REQUIREMENTS. THE USER ASSUMES ALL RESPONSIBILITY FOR THE PROPER APPLICATION OF THE PRODUCT. THE USER SHALL BE RESPONSIBLE FOR THE PROPER APPLICATION OF THE PRODUCT. THE USER SHALL BE RESPONSIBLE FOR THE PROPER APPLICATION OF THE PRODUCT. THE USER SHALL BE RESPONSIBLE FOR THE PROPER APPLICATION OF THE PRODUCT.

**APPROVALS**

PCE DES	
APP ENG	

**ANALOG DEVICES**  
**LTW**  
 Precision Analog

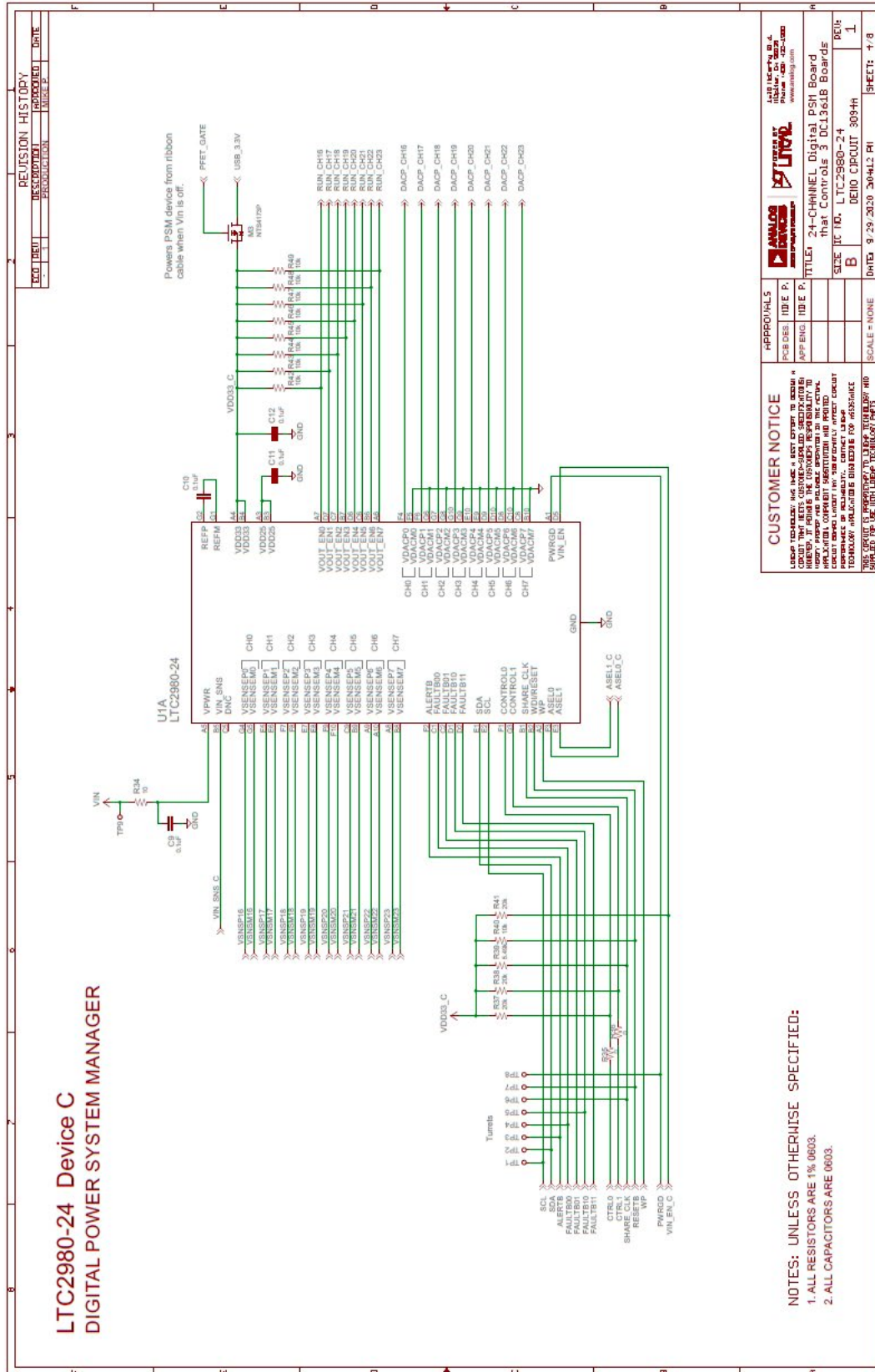
**TITLE** LTC2980-24 Manages Three DC1381B Boards  
**SIZE** IIC 10, LTC2980-24  
**REV:** B  
**DEMO CIRCUIT** 309-H  
**DATE:** 9/29/2020 300412.PRI  
**SHEET:** 1/8





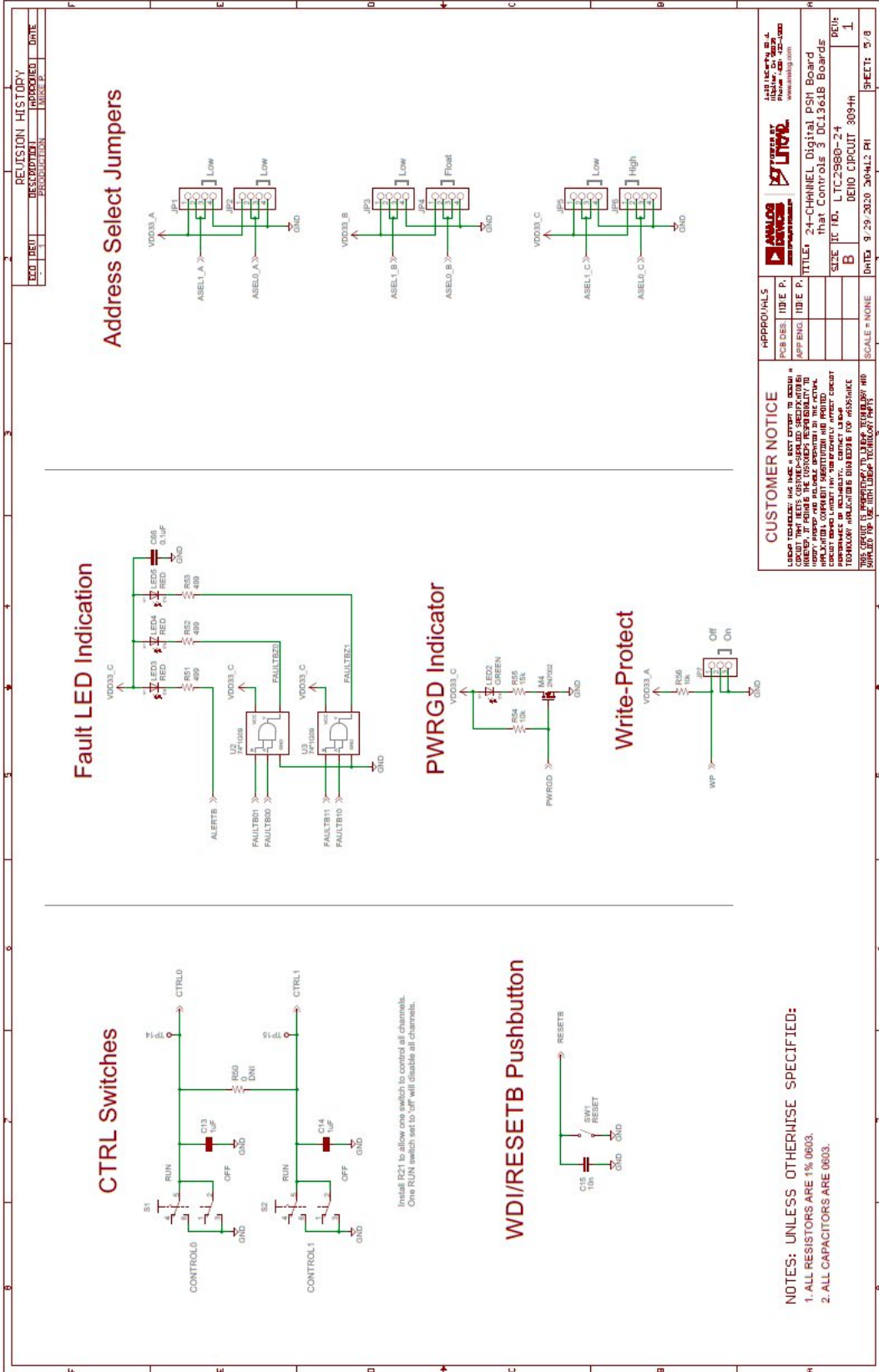


## SCHEMATIC DIAGRAM



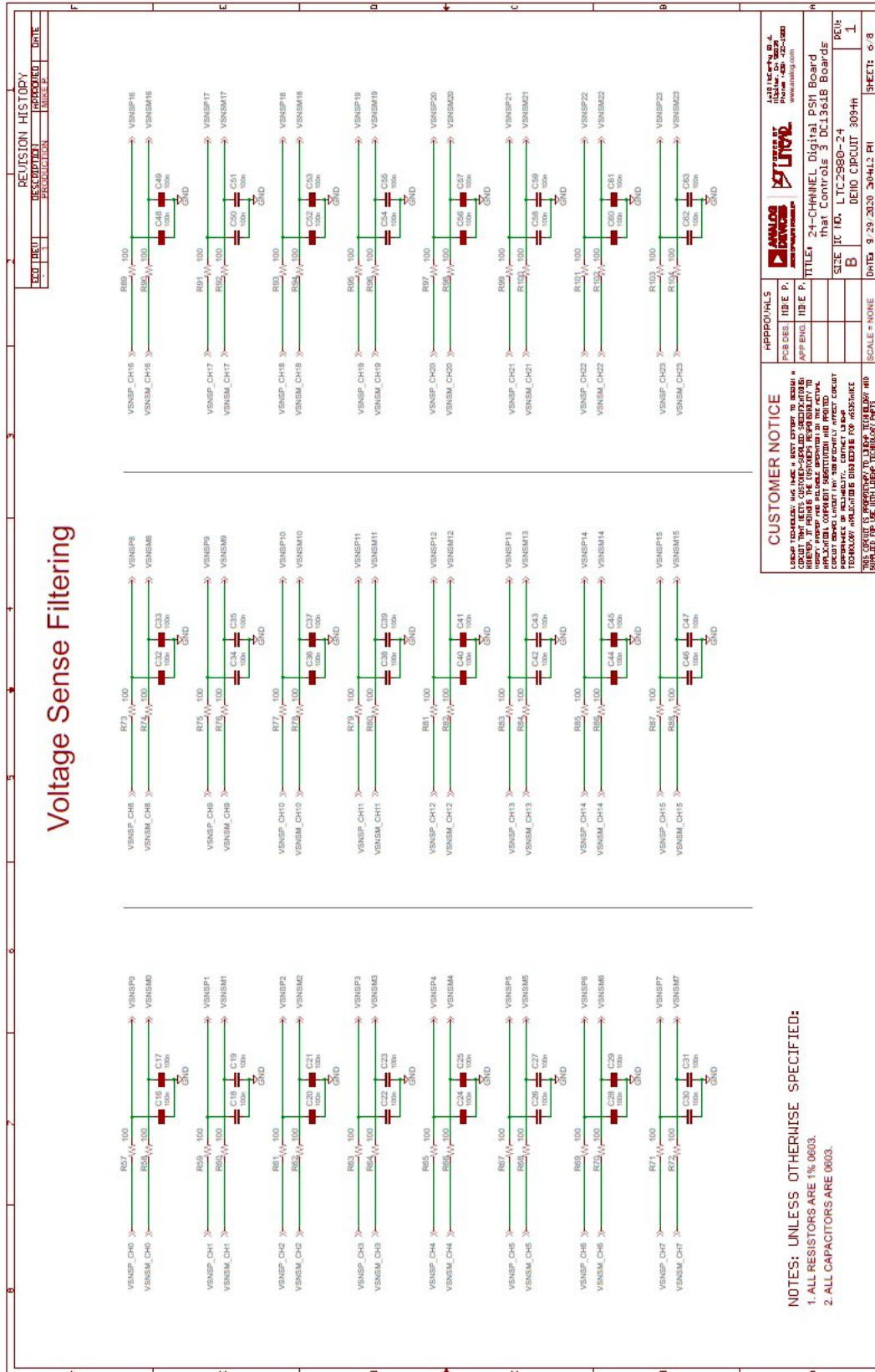
# DEMO MANUAL DC3097A-KIT

## SCHEMATIC DIAGRAM





## SCHEMATIC DIAGRAM



NOTES: UNLESS OTHERWISE SPECIFIED:  
 1. ALL RESISTORS ARE 1% 0603.  
 2. ALL CAPACITORS ARE 0603.

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**APPROVALS**

DESIGN	DATE
APP'G	DATE

**APPROVALS**

DESIGN	DATE
APP'G	DATE

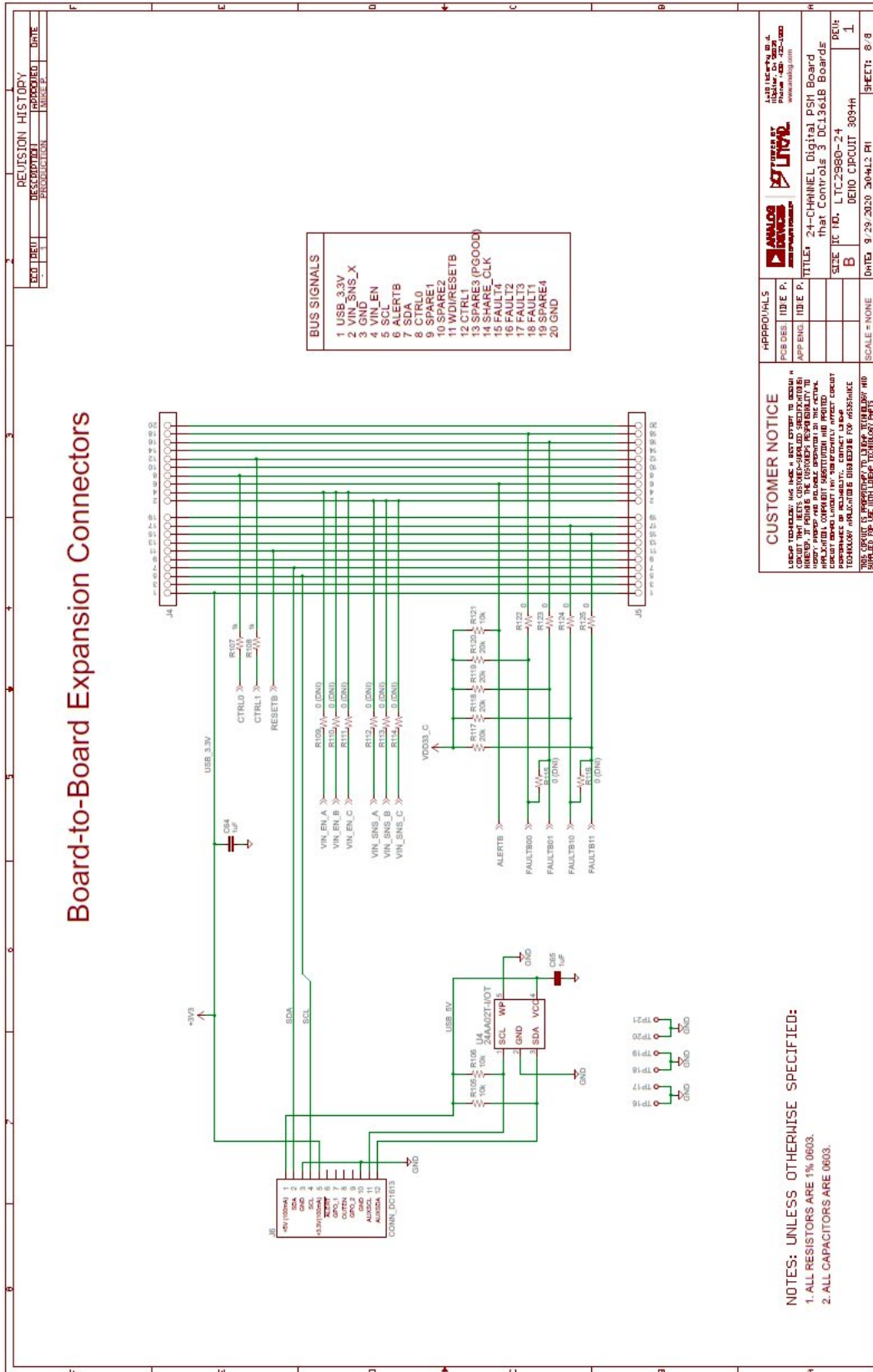
**DESIGNER:** J. W. WILSON  
**DATE:** 9/29/2020 3:04:12 PM  
**SCALE:** NONE  
**SHEET:** 0/8

**TITLE:** 24-CHANNEL Digital PS1 Board that Controls 3 DC1364B Boards  
**SIC:** IC 10, LTC2980-24  
**REV:** I  
**DEMO CIRCUIT:** 3097H



**SCHEMATIC DIAGRAM**

**Board-to-Board Expansion Connectors**



REVISION HISTORY	
REV	DATE
000	0000
001	0000
002	0000
003	0000
004	0000
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APPROVALS	DATE
DESIGN	0000
APPEN	0000
SCALE	NONE

CUSTOMER NOTICE	
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TITLE	REV
24-CHANNEL Digital PSH Board that Controls 3 DC1364B Boards	1
SICE IIC ID, LTC2980-24	B
DEMO CIRCUIT 309-H	I

DATE	REV	SHEET
9/29/2020	30041.2	8/8

NOTES: UNLESS OTHERWISE SPECIFIED:  
1. ALL RESISTORS ARE 1% 0603.  
2. ALL CAPACITORS ARE 0603.



### ESD Caution

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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