

## LTM4673 Quad Output $\mu$ Module Regulator with Digital Power System Management

### DESCRIPTION

Demonstration circuit 2810A features the [LTM<sup>®</sup>4673](#): the wide input and output voltage range, high efficiency and power density, quad output DC/DC step-down  $\mu$ Module<sup>®</sup> regulator with Digital Interface for control and monitoring. The DC2810A default input voltage range is 4.5V to 15V. However, if  $V_{IN}$  is lower than 4.5V, minor modification to certain existing onboard components is required. Please refer to Step 8: Operation at  $V_{IN} \leq 4.5V$  in Quick Start Procedure section. The factory default output voltages are  $V_{OUT0} = 1V$ ,  $V_{OUT3} = 0.9V$  at 12A per channel;  $V_{OUT1} = 1.2V$ ,  $V_{OUT2} = 1.8V$  at 5A per channel. The DC2810A output voltages can be adjusted from 0.6V up to 3.3V for channel 0 and channel 3 and from 0.6V to 5.5V for channel 1 and channel 2. The default switching frequencies are 600kHz for channel 0 and channel 3 and 1MHz for channel 1 and channel 2. Forced airflow and heatsink might also be used to further optimize the output power when all output rails are on and fully loaded. Programming the output voltages to values greater than 1.8V, may require derating output current based on thermal derating curves provided in the data sheet of the

LTM4673. The DC2810A comes with PMBus interface and digital power system management functions. An onboard 12-pin connector is available for users to connect the dongle [DC1613A](#) to the DC2810A and provides an easy way to communicate and program the part using LTpowerPlay<sup>®</sup> software development tool. LTpowerPlay software and I<sup>2</sup>C/PMBus/SMBus Dongle DC1613A allows users to monitor real time telemetry of input and output voltages, input and output current, internal IC die temperatures, and fault logs.

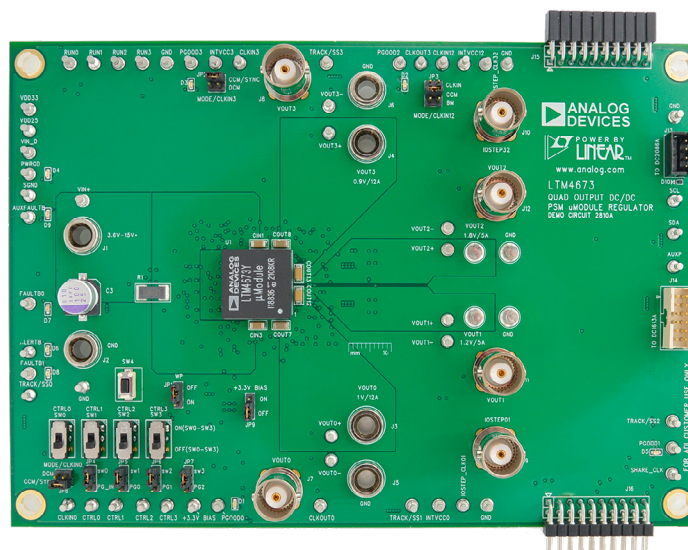
The LTM4673 is available in a thermally enhanced, low profile, 361-Lead (16mm  $\times$  16mm  $\times$  4.72mm) BGA package. It is recommended to read the data sheet and demo manual of LTM4673 prior to use or making any hardware changes to DC2810A.

LTpowerPlay software can be downloaded [here](#). The USB to PMBus Controller Dongle DC1613A for use with LTpowerPlay is available [here](#).

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

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### BOARD PHOTO Part marking is either ink mark or laser mark



# DEMO MANUAL DC2810A

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

| PARAMETER                                                  | CONDITIONS                                                                                                                                                                                                                                                                                         | CHANNEL                                              | MIN  | TYP                          | MAX | UNITS            |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------|------------------------------|-----|------------------|
| <b>4-Phase Quad Output</b>                                 |                                                                                                                                                                                                                                                                                                    |                                                      |      |                              |     |                  |
| Input Voltage Range                                        |                                                                                                                                                                                                                                                                                                    |                                                      | 4.5* | 12                           | 16  | V                |
| Demo Board Default Output Voltages                         | $V_{IN} = 4.5\text{V to }15\text{V}$ ; DAC Soft-Connect<br>$I_{LOAD} = 0\text{A to }12\text{A}$<br>$I_{LOAD} = 0\text{A to }5\text{A}$<br>$I_{LOAD} = 0\text{A to }5\text{A}$<br>$I_{LOAD} = 0\text{A to }12\text{A}$                                                                              | $V_{OUT0}$<br>$V_{OUT1}$<br>$V_{OUT2}$<br>$V_{OUT3}$ |      | 1.0<br>1.2<br>1.8<br>0.9     |     | V<br>V<br>V<br>V |
| Default Switching Frequency                                | Factory Default Switching Frequency                                                                                                                                                                                                                                                                | $V_{OUT0}, V_{OUT3}$<br>$V_{OUT1}, V_{OUT2}$         |      | 600<br>1000                  |     | kHz<br>kHz       |
| Maximum Continuous Output Current<br>$I_{OUT}$ per Channel | $V_{IN} = 4.5\text{V to }15\text{V}$<br>$V_{OUT0} = 1\text{V}$ ; $f_{SW} = 600\text{kHz}$<br>$V_{OUT1} = 1.2\text{V}$ ; $f_{SW} = 1000\text{kHz}$<br>$V_{OUT2} = 1.8\text{V}$ ; $f_{SW} = 1000\text{kHz}$<br>$V_{OUT3} = 0.9\text{V}$ ; $f_{SW} = 600\text{kHz}$                                   | $I_{OUT0}$<br>$I_{OUT1}$<br>$I_{OUT2}$<br>$I_{OUT3}$ |      | 12<br>5<br>5<br>12           |     | A<br>A<br>A<br>A |
| Efficiency                                                 | $V_{IN} = 4.5\text{V}$ ; CCM<br>$V_{OUT0} = 1\text{V}$ ; $f_{SW} = 600\text{kHz}$ ; 12A Load<br>$V_{OUT1} = 1.2\text{V}$ ; $f_{SW} = 1000\text{kHz}$ ; 5A Load<br>$V_{OUT2} = 1.8\text{V}$ ; $f_{SW} = 1000\text{kHz}$ ; 5A Load<br>$V_{OUT3} = 0.9\text{V}$ ; $f_{SW} = 600\text{kHz}$ ; 12A Load | CH0<br>CH1<br>CH2<br>CH3                             |      | 86.3<br>81.4<br>86.3<br>85.3 |     | %<br>%<br>%<br>% |
| Efficiency                                                 | $V_{IN} = 12\text{V}$ ; CCM<br>$V_{OUT0} = 1\text{V}$ ; $f_{SW} = 600\text{kHz}$ ; 12A Load<br>$V_{OUT1} = 1.2\text{V}$ ; $f_{SW} = 1000\text{kHz}$ ; 5A Load<br>$V_{OUT2} = 1.8\text{V}$ ; $f_{SW} = 1000\text{kHz}$ ; 5A Load<br>$V_{OUT3} = 0.9\text{V}$ ; $f_{SW} = 600\text{kHz}$ ; 12A Load  | CH0<br>CH1<br>CH2<br>CH3                             |      | 84.6<br>79.5<br>85<br>82.9   |     | %<br>%<br>%<br>% |

\*See Step 8: Operation at  $V_{IN} \leq 4.5\text{V}$  in Quick Start Procedure section for more information.

## QUICK START PROCEDURE

Demonstration circuit 2810A is easy to setup to evaluate the performance of the LTM4673. Please refer to Figure 1 for proper measurement equipment setup and follow the test procedures below:

1. With power off, connect the input power supply between VIN (J1) and GND (J2).
2. Connect the first load between VOUT0 (J3) and GND (J5) for channel 0, connect the second load between VOUT1 (E16) and GND (E18) for channel 1, connect the third load between VOUT2 (E17) and GND (E19) for channel 2, connect the fourth load between VOUT3 (J4) and GND (J6) for channel 3. Preset all the loads to 0A.
3. Connect the DMM between the input test points: VIN+ (E1) and VIN– (E2) to monitor the input voltage. Connect DMMs between VOUT0+ (E4) and VOUT0 (E7), VOUT1+ (E44) and VOUT1– (E45), VOUT2+ (E46) and VOUT2– (E47), VOUT3+ (E5) and VOUT3– (E8), to monitor corresponding DC output voltages of channel 0, channel 1, channel 2 and channel 3.
4. Prior to powering up the DC2810A, check the default position of the jumpers and switches. Make sure the CONTROL switches are set in the “OFF” position before the next step. Refer to Table 1.

## QUICK START PROCEDURE

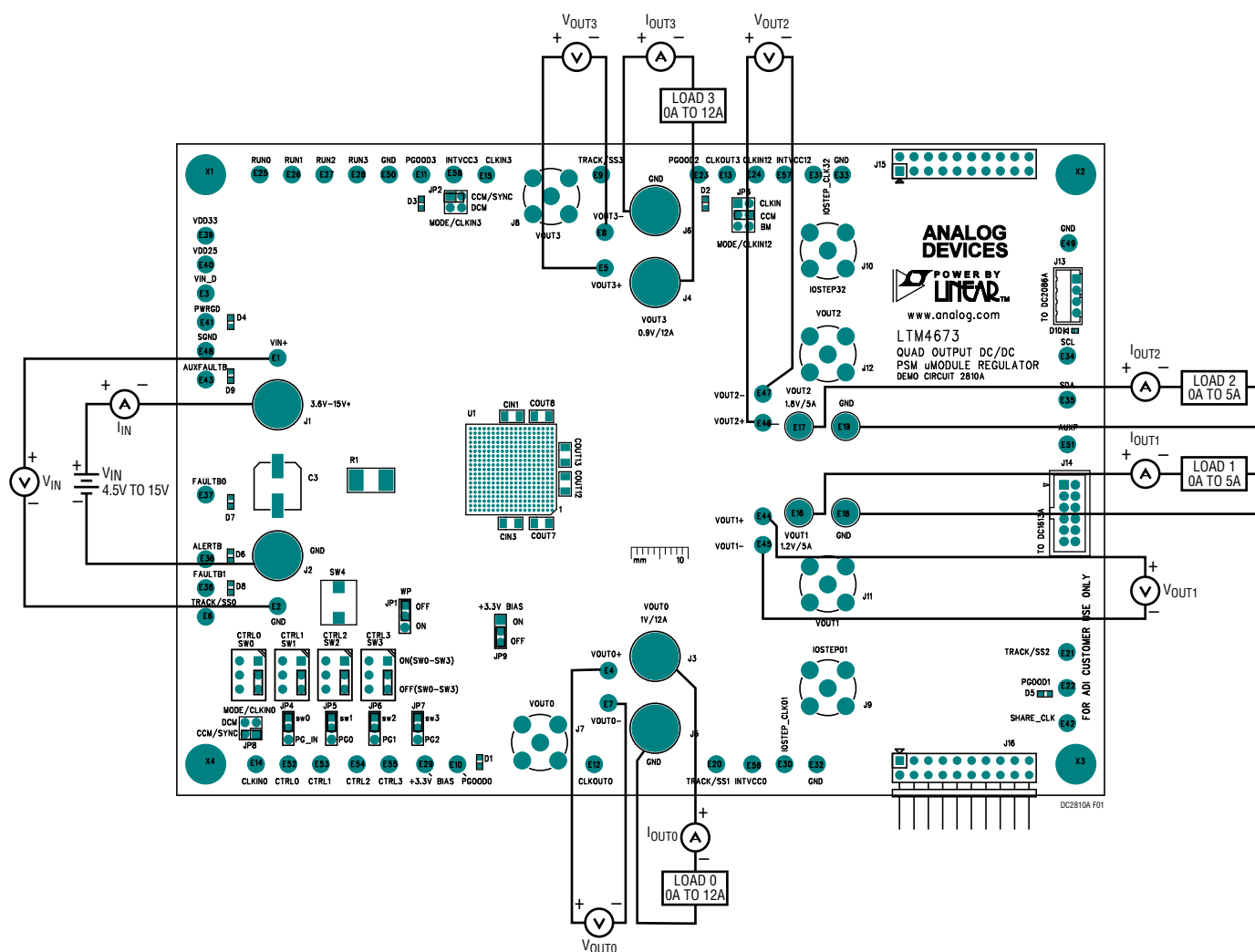


Figure 1. Proper Measurement Equipment Setup for DC2810A

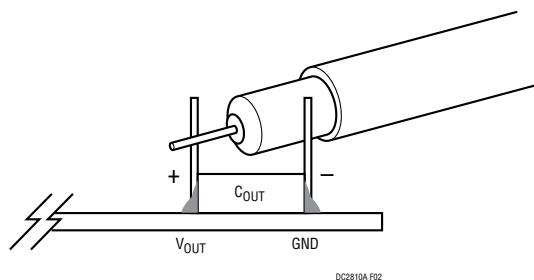
Table 1. Demo Board Default Jumpers and Switches Position

| JUMPER/SWITCH NAME | DESCRIPTION                            | DEFAULT POSITION |
|--------------------|----------------------------------------|------------------|
| SW0, SW1, SW2, SW3 | CTRL0, CTRL1, CTRL2, CTRL3             | OFF              |
| JP1                | WP                                     | OFF              |
| JP2, JP3, JP8      | MODE/CLKIN0, MODE/CLKIN12, MODE/CLKIN3 | CCM              |
| JP4                | CH0 Sequence Configuration             | SW0              |
| JP5                | CH1 Sequence Configuration             | SW1              |
| JP6                | CH2 Sequence Configuration             | SW2              |
| JP7                | CH3 Sequence Configuration             | SW3              |
| JP9                | 3.3V BIAS                              | OFF              |

## QUICK START PROCEDURE

- Turn on the power supply at the input. Measure and bring up the input supply voltage to 12V. Flip SW0 (CTRL0), SW1 (CTRL1), SW2 (CTRL2), SW3 (CTRL3), to the “ON” position. The typical output voltages should be  $1.0V \pm 0.5\%$  for  $V_{OUT0}$ ,  $1.2V \pm 0.5\%$  for  $V_{OUT1}$ ,  $1.8V \pm 0.5\%$  for  $V_{OUT2}$ , and  $0.9V \pm 0.5\%$  for  $V_{OUT3}$ .
- Once the output voltages are properly established, vary the input voltage between 4.5V to 15V max. Vary the load current within the operating range of 0A to 12A for channels 0 and 3 and an operating range of 0A to 5A for channels 1 and 2. Observe the output voltage regulation, output ripple voltage, switching node waveforms, and other parameters.

NOTE: To measure the input/output voltage ripples properly, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper probing technique of input/output voltage ripples. Short, stiff leads need to be soldered to the (+) and (–) terminals of an input or output capacitor. The probe’s ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.



**Figure 2. Scope Probe Placement for Measuring Input or Output Ripple Voltage**

- DC2810A alternatively provides convenient onboard BNC terminals to accurately measure the output ripple voltage of channel 0, 1, 2 and 3. Connect short BNC cables from VOUT0 (J7), VOUT1 (J11), VOUT2 (J12), and VOUT3 (J8) to the input channels of an oscilloscope. (Scope probe ratio 1:1, AC-coupling) to observe the output ripple voltage.
- Operation at  $V_{IN} \leq 4.5V$ :  
LTM4673 can be operated from 3.6V to 4.5V by using the onboard “3.3V bias” circuit. To use this circuit, set

3.3V Bias jumper to the ON position, remove R2 and stuff R4 and R77 with  $0\Omega$  resistors. Input Voltage parameters must be changed in LTpowerPlay to allow the part to operate at low  $V_{IN}$  voltages. Additional input electrolytic capacitors may be installed between  $V_{IN}$  (J1) and GND (J2) to prevent  $V_{IN}$  from drooping or overshoot to a voltage level that can exceed the specified minimum  $V_{IN}$  (3.6V) and maximum  $V_{IN}$  (4.5V) during large output load transient.

Similarly, the part can be run from a single 3.3V voltage supply by stuffing R4, R2 and R77 with  $0\Omega$  resistors and placing the 3.3V jumper in the OFF position. Do not exceed 3.6V when configuring the board this way.

### 9. Onboard Load-Step Circuit:

DC2810A provides onboard load transient circuits to quickly check  $\Delta V_{OUT}$  peak-to-peak deviation during rising or falling dynamic load transients for each channel.

The simple load-step circuit consists of a 20V N-channel power MOSFET in series with a  $10m\Omega$ , 0.5W, 1% current sense resistor. The MOSFET is configured as a voltage control current source (VCCS) device; therefore, the output current step and its magnitude is created and controlled by adjusting the amplitude of the applied input voltage step at the gate of the MOSFET. Use a function generator to provide a voltage pulse between IOSTEP\_CLK01 (E30) and GND; this voltage pulse should be set at a pulse width less than  $300\mu s$  and maximum duty cycle less than 2% to avoid excessive thermal stress on the MOSFET devices. The output current step is measured directly across the current sense resistors and monitored by connecting BNC cable from IOSTEP\_01 (J9) to the input of the oscilloscope (scope probe ratio 1:1, DC-coupling). The equivalent voltage to current scale is  $10mV/1A$ . The load step current slew rate  $di/dt$  can be varied by adjusting the rise time and fall time of the input voltage pulse. The load-step circuit of channel 0 or channel 1 is connected to  $V_{OUT0}$  by default but can be used for  $V_{OUT1}$  by simply removing the zero-ohm resistor R94 and stuffing it at the position of R100 and vice versa. Only one resistor: R94 or R100 can be stuffed at a time to avoid shorting  $V_{OUT0}$  and  $V_{OUT1}$  together.

## QUICK START PROCEDURE

Similarly, load-step transient evaluation of  $V_{OUT2}$  or  $V_{OUT3}$  can be performed using the same method described above using the second onboard dynamic load circuit.

### 10. Connecting a PC to DC2810A:

Refer to Figure 3 for proper demo board setup with PC. Users can use a PC to reconfigure the

power management features of the LTM4673 such as: nominal  $V_{OUT}$ , margin set points, OV/UV limits, OC/UC limits, temperature fault limits, sequencing parameters, the fault logs, fault responses, GPIOs and other functionality. The DC1613A dongle can be hot plugged when  $V_{IN}$  is present.

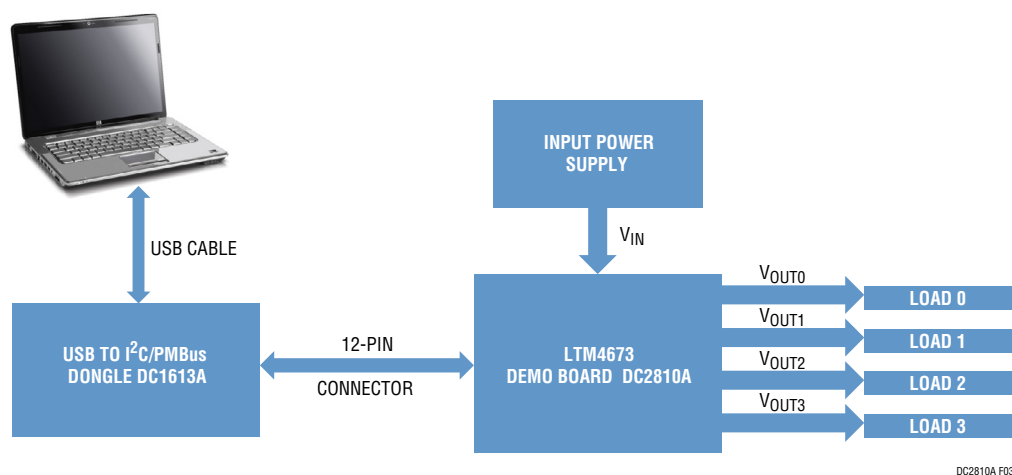
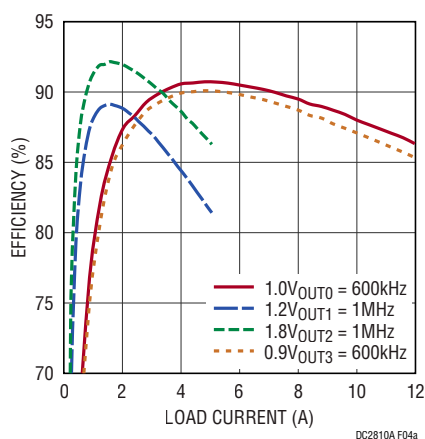
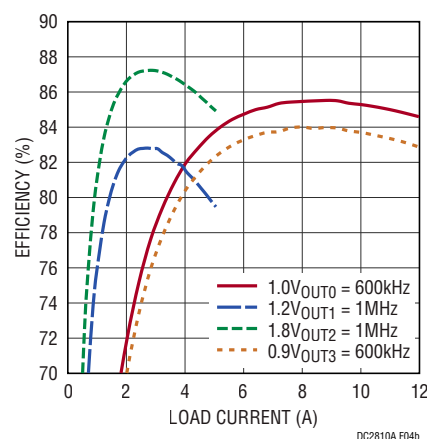


Figure 3. DC2810A Demo Board Setup with PC for DC2810A

## TEST RESULTS



(a) 4.5 $V_{IN}$  CCM Efficiency



(b) 12 $V_{IN}$  CCM Efficiency

Figure 4. Measured Supply Efficiency

# DEMO MANUAL DC2810A

## TEST RESULTS

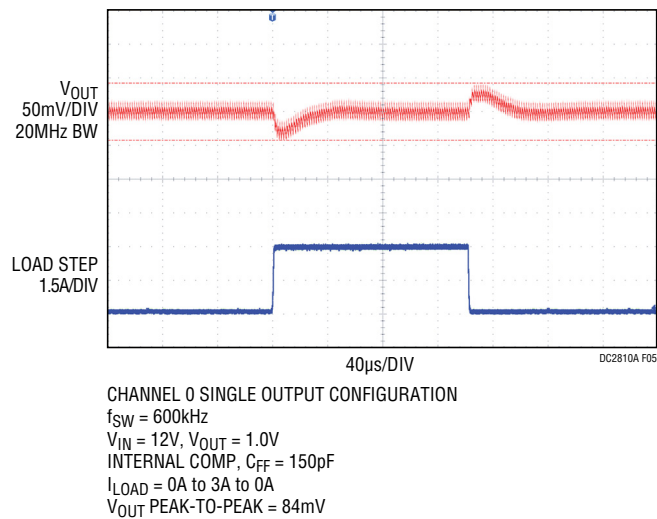


Figure 5. DC2810A: Channel 0 Load Transient Response

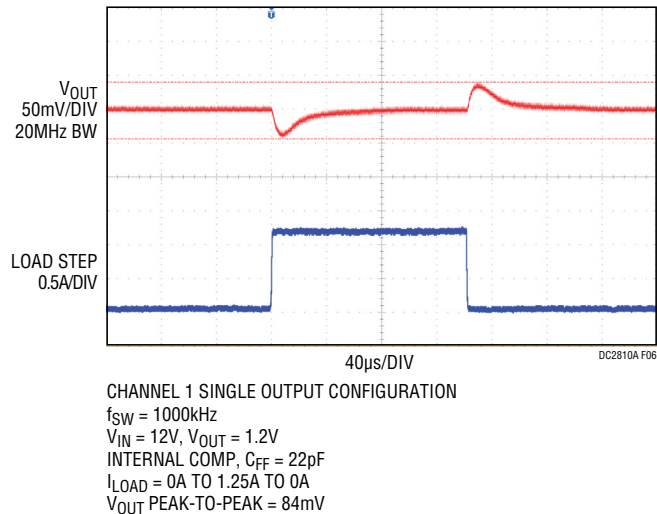


Figure 6. DC2810A: Channel 1 Load Transient Response

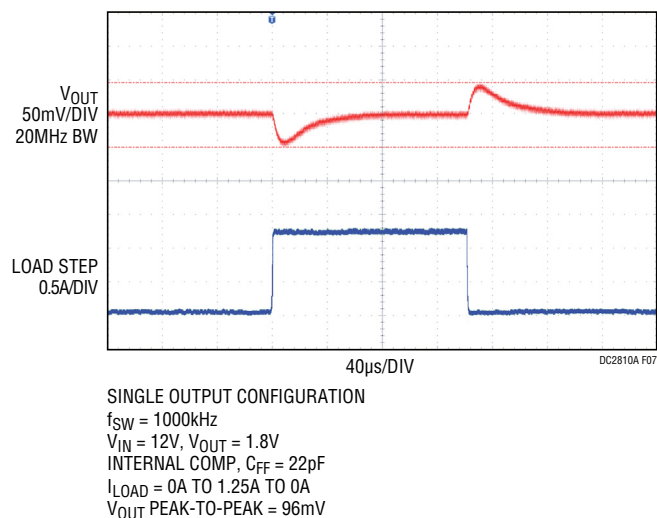


Figure 7. DC2810A: Channel 2 Load Transient Response

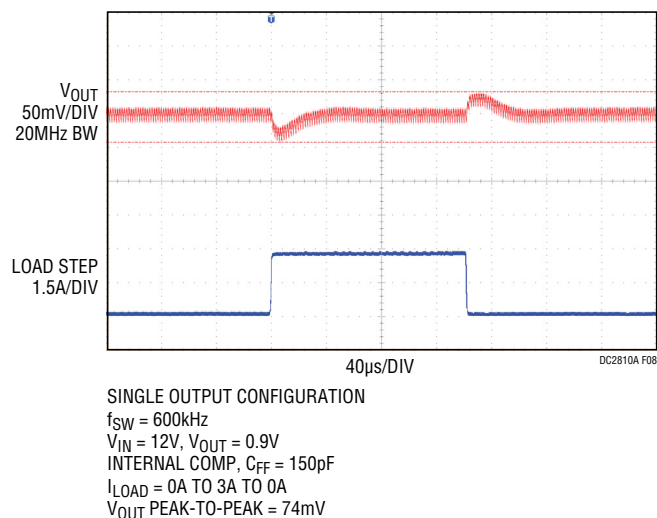


Figure 8. DC2810A: Channel 3 Load Transient Response



## TEST RESULTS

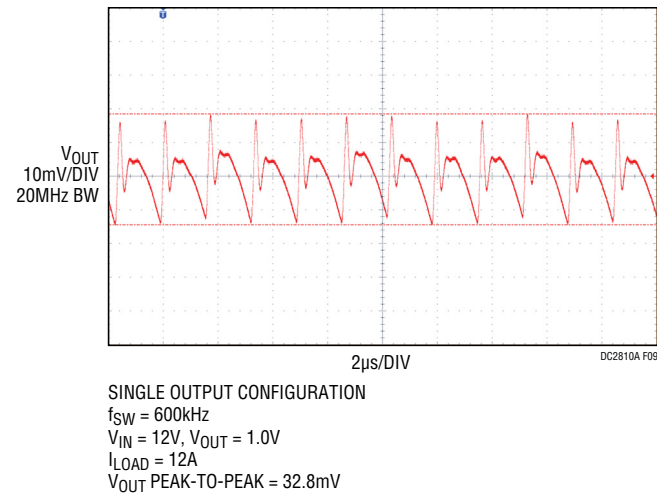


Figure 9. DC2810A: Channel 0 Output Voltage Ripple

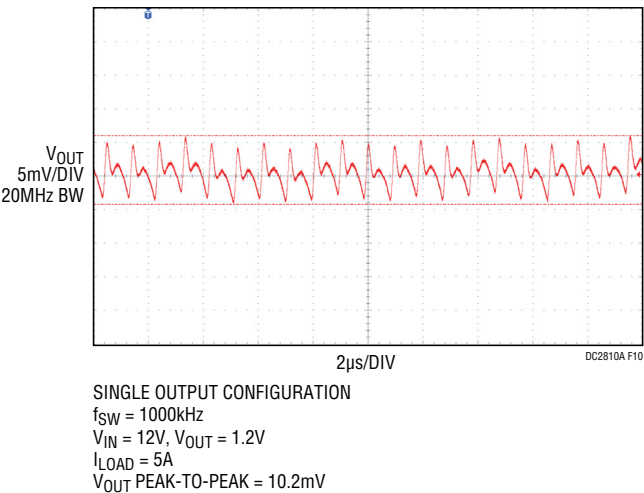


Figure 10. DC2810A: Channel 1 Output Voltage Ripple

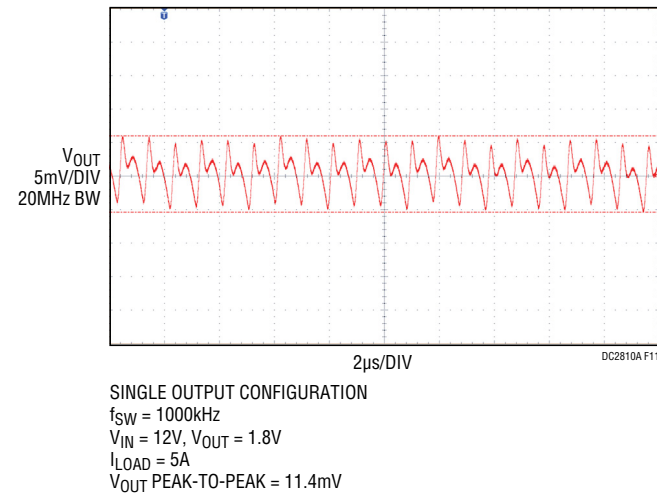


Figure 11. DC2810A: Channel 2 Output Voltage Ripple

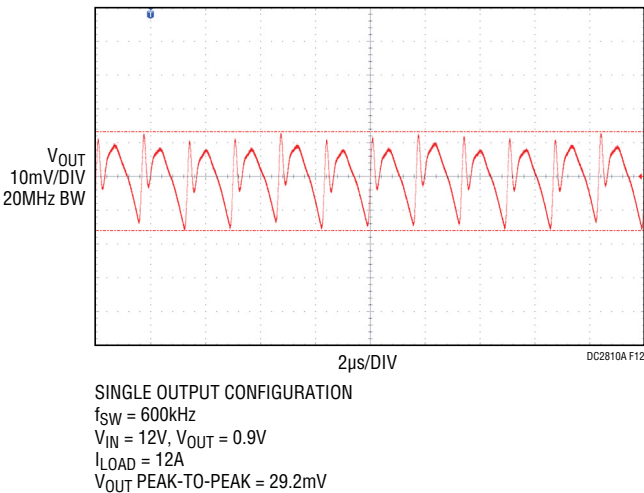
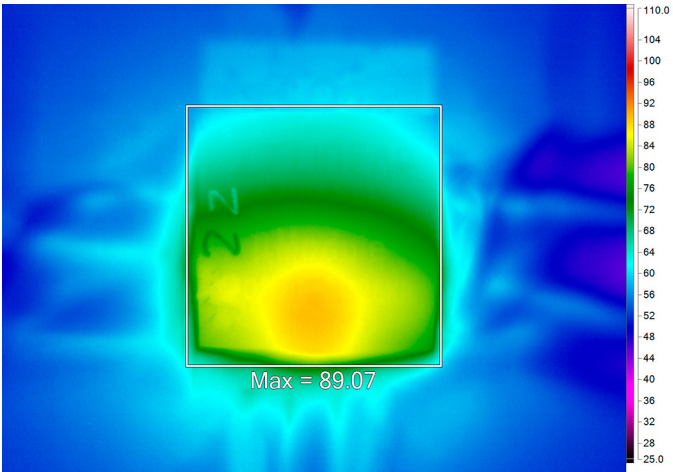


Figure 12. DC2810A: Channel 3 Output Voltage Ripple

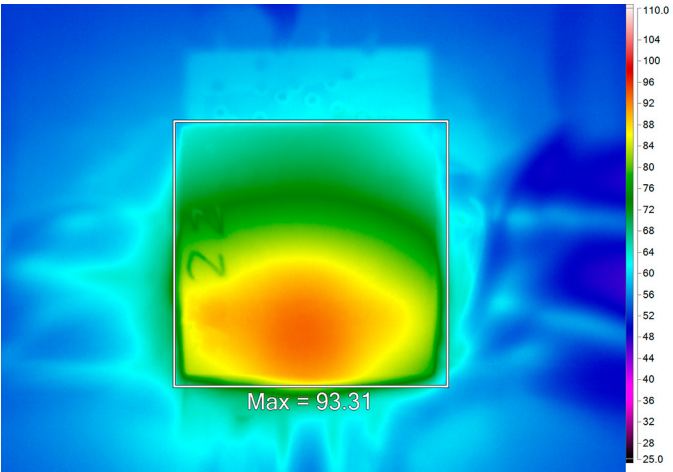
TEST RESULTS



| $V_{IN}$ (V) | HEATSINK | AMBIENT (°C) | MAX CASE TEMP (°C) |
|--------------|----------|--------------|--------------------|
| 4.5          | NONE     | 23           | 89.07              |

| CHANNEL       | $V_{OUT0}$ | $V_{OUT1}$ | $V_{OUT2}$ | $V_{OUT3}$ |
|---------------|------------|------------|------------|------------|
| $V_{OUT}$ (V) | 1.0        | 1.2        | 1.8        | 0.9        |
| $I_{OUT}$ (A) | 12         | 5          | 5          | 12         |

(a)



| $V_{IN}$ (V) | HEATSINK | AMBIENT (°C) | MAX CASE TEMP (°C) |
|--------------|----------|--------------|--------------------|
| 12           | NONE     | 23           | 93.31              |

| CHANNEL       | $V_{OUT0}$ | $V_{OUT1}$ | $V_{OUT2}$ | $V_{OUT3}$ |
|---------------|------------|------------|------------|------------|
| $V_{OUT}$ (V) | 1.0        | 1.2        | 1.8        | 0.9        |
| $I_{OUT}$ (A) | 12         | 5          | 5          | 12         |

(b)

Figure 13. Measured Thermal Captures without Forced Airflow



## LTpowerPlay QUICK START GUIDE

LTpowerPlay is a powerful Windows-based development environment that supports ADI power system management ICs. The software supports a variety of different tasks. You can use LTpowerPlay to evaluate ADI PSM ICs by connecting to a demo board system. LTpowerPlay can also be used in an offline mode (with no hardware present) to build a multichip configuration file that can be saved and reloaded anytime. LTpowerPlay provides unprecedented diagnostic tool 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 DC1613A USB-to-SMBus

controller to communicate with one of many potential targets, including all the parts in PSM product category demo system. The software also provides an automatic update feature to keep the software current with the latest set of device drivers and documentation. The LTpowerPlay software can be downloaded [here](#).

To access technical support documents for ADI Digital Management Products, visit Help or view online help on the LTpowerPlay menu.

The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTM4673:

1. Download and install the [LTpowerPlay GUI](#).

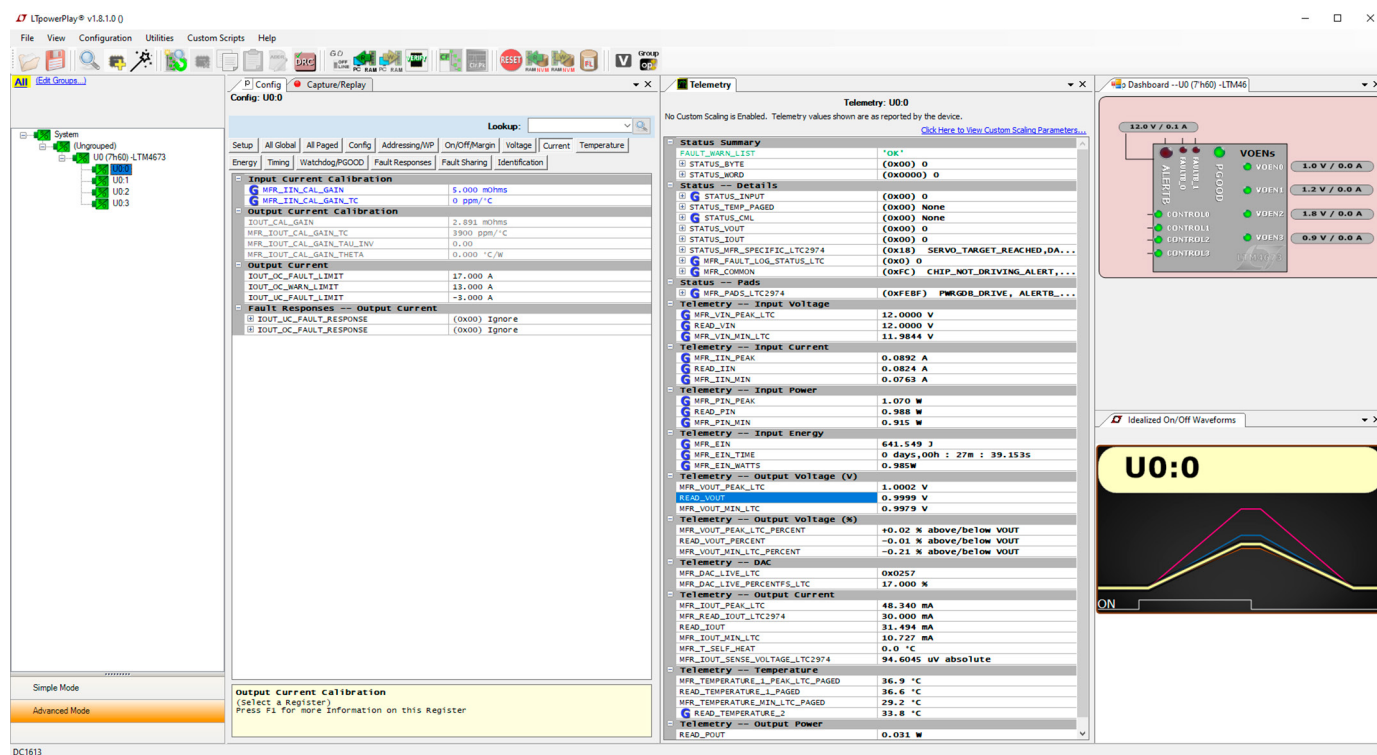
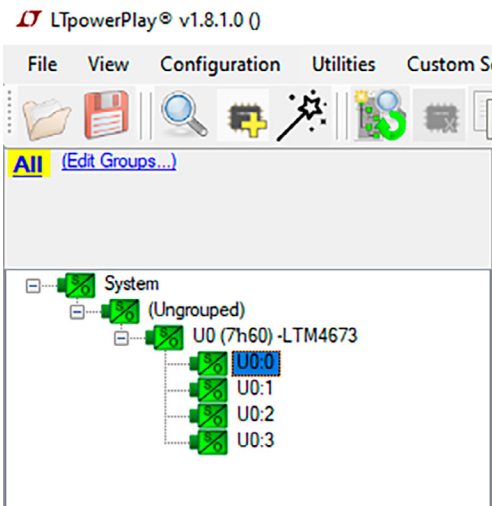


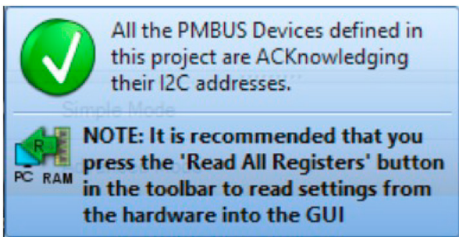
Figure 14. LTpowerPlay Main Interface

LTpowerPlay QUICK START GUIDE

2. Launch the LTpowerPlay GUI.
- a. The GUI should automatically identify the DC2810A. The system tree on the left-hand side should look like this:



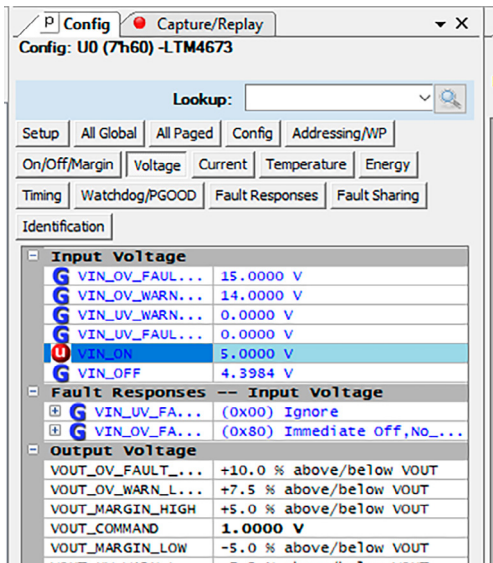
- b. A message box shows for a few seconds in the lower left-hand corner, confirming that the LTM4673 is communicating:



- c. In the Toolbar, click the “R” (RAM to PC) icon to read the RAM from the LTM4673. The configuration is read from LTM4673 and loaded into the GUI.



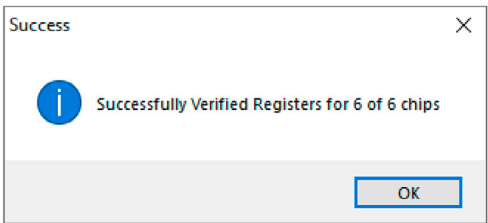
- d. For example, the  $V_{IN}$  Turn on voltage can be programmed to a different value: In the Config Tab, click on the “Voltage” box in the main menu bar and type in “5.0” in the VIN\_ON box as shown below:



Then click the “W” (PC to RAM) icon to write these register values to the LTM4673.



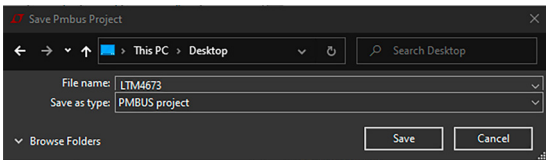
The  $V_{IN}$  turn on voltage will change to 5V. If the write is successful, the following message should be seen:



- e. All user configurations or changes can be saved in to the NVM. In the toolbar, click “RAM to NVM” icon:



- f. Save the demo board configuration to a (\*.proj) file. Click the “Save” icon and save the file with a preferred file name.



## PARTS LIST

| ITEM                               | QTY | REFERENCE                                                            | PART DESCRIPTION                                                     | MANUFACTURER/PART NUMBER                    |
|------------------------------------|-----|----------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------|
| <b>Required Circuit Components</b> |     |                                                                      |                                                                      |                                             |
| 1                                  | 3   | C1, C5, C12                                                          | CAP, 2.2μF, X5R, 6.3V, 10%, 0603                                     | AVX, 06036D225KAT2A                         |
| 2                                  | 9   | C2, C6, C21, C22, C39, C41-C44                                       | CAP, 0.1μF, X7R, 16V, 10%, 0603, FLEXITERM                           | AVX, 0603YC104KAZ2A                         |
| 3                                  | 2   | C3, C4                                                               | CAP, 100μF, ALUM, OS-CON, 25V, 20%, 8mm × 6.9mm SMD, E7, SVPF SERIES | PANASONIC, 25SVPF100M                       |
| 4                                  | 3   | C7, C9, C10                                                          | CAP, 1μF, X7R, 25V, 10%, 0603, AEC-Q200                              | MURATA, GCM188R71E105KA64D                  |
| 5                                  | 1   | C11                                                                  | CAP, 10μF, X5R, 25V, 20%, 0603, NO SUBS. ALLOWED                     | MURATA, GRM188R61E106MA73D                  |
| 6                                  | 2   | C15, C16                                                             | CAP, 150pF, X7R, 50V, 10%, 0603                                      | AVX, 06035C151KAT2A                         |
| 7                                  | 2   | C23, C24                                                             | CAP, 22pF, C0G, 50V, 5%, 0603                                        | AVX, 06035A220JAT2A                         |
| 8                                  | 6   | C27, C28, C45-C48                                                    | CAP, 0.01μF, X7R, 16V, 10%, 0603                                     | AVX, 0603YC103KAT2A                         |
| 9                                  | 1   | C29                                                                  | CAP, 1μF, X7R, 16V, 10%, 0603                                        | KEMET, C0603C105K4RAC7867                   |
| 10                                 | 1   | C35                                                                  | CAP, 10μF, X7R, 25V, 10%, 1206                                       | KEMET, C1206C106K3RACTU                     |
| 11                                 | 1   | C36                                                                  | CAP, 10μF, X5R, 16V, 20%, 1210                                       | AVX, 1210YD106MAT2A                         |
| 12                                 | 1   | C37                                                                  | CAP, 0.01μF, X7R, 6.3V, 10%, 0603                                    | AVX, 06036C103KAT2A                         |
| 13                                 | 6   | C38, C40, COUT3, COUT4, COUT7, COUT8                                 | CAP, 100μF, X5R, 6.3V, 10%, 1206                                     | MURATA, GRM31CR60J107KE39L                  |
| 14                                 | 4   | CIN1-CIN4                                                            | CAP, 22μF, X5R, 25V, 10%, 1206                                       | AVX, 12063D226KAT2A                         |
| 15                                 | 2   | COUT2, COUT5                                                         | CAP, 330μF, TANT, POSCAP, 6.3V, 20%, 7343, 10mΩ, TPF                 | PANASONIC, 6TPF330M9L                       |
| 16                                 | 2   | COUT10, COUT15                                                       | CAP, 10μF, X5R, 6.3V, 10%, 0805                                      | AVX, 08056D106KAT2A                         |
| 17                                 | 4   | COUT11-COUT14                                                        | CAP, 47μF, X5R, 6.3V, 20%, 1206                                      | MURATA, GRM31CR60J476ME19L                  |
| 18                                 | 5   | D1-D5                                                                | LED, GREEN, WATER CLEAR, 0603                                        | WURTH ELEKTRONIK, 150060GS75000             |
| 19                                 | 4   | D6-D9                                                                | LED, RED, WATER CLEAR, 0603                                          | WURTH ELEKTRONIK, 150060RS75000             |
| 20                                 | 1   | D10                                                                  | DIODE, SCHOTTKY, 20V, 0.5A, SOD-882, LEADLESS                        | NEXPERIA, PMEG2005AEL, 315                  |
| 21                                 | 1   | Q1                                                                   | XSTR., MOSFET, P-CH, 30V, 3.3A, SOT-23-3                             | DIODES INC., DMP3068L-13                    |
| 22                                 | 2   | Q2, Q3                                                               | XSTR., MOSFET, N-CH, 40V, 14A, DPAK (TO-252)                         | VISHAY, SUD50N04-8M8P-4GE3                  |
| 23                                 | 5   | Q4-Q8                                                                | XSTR., MOSFET, N-CH, 60V, 220mA, SOT23-3, AEC-Q101                   | DIODES INC., 2N7002A-13                     |
| 24                                 | 4   | Q9-Q12                                                               | XSTR., MOSFET, P-CH, 20V, 5.9A, SOT-23-3 (TO-236-3)                  | VISHAY, Si2365EDS-T1-GE3                    |
| 25                                 | 1   | R1                                                                   | RES., 0.005Ω, 1%, 3W, 2512, METAL, SENSE, AEC-Q200                   | PANASONIC, ERJMS4HF5M0U                     |
| 26                                 | 16  | R2, R12, R15, R18-R21, R30, R31, R34, R38, R39, R50, R51, R122, R124 | RES., 0Ω, 1/10W, 0603, AEC-Q200                                      | VISHAY, CRCW06030000Z0EA                    |
| 27                                 | 6   | R3, R37, R132-R135                                                   | RES., 10Ω, 1%, 1/10W, 0603                                           | VISHAY, CRCW060310R0FKEA                    |
| 28                                 | 2   | R5, R6                                                               | RES., 100Ω, 1%, 1/10W, 0603, AEC-Q200                                | PANASONIC, ERJ3EKF1000V                     |
| 29                                 | 2   | R8, R9                                                               | RES., 1Ω, 1%, 1/10W, 0603                                            | YAGEO, RC0603FR-071RL                       |
| 30                                 | 4   | R10, R11, R32, R33                                                   | RES., 0Ω, JUMPER, 0603, AEC-Q200                                     | KOA SPEER, RK73Z1JTDD                       |
| 31                                 | 1   | R13                                                                  | RES., 90.9k, 1%, 1/10W, 0603, AEC-Q200                               | VISHAY, CRCW060390K9FKEA                    |
| 32                                 | 1   | R14                                                                  | RES., 121k, 1%, 1/10W, 0603                                          | NIC, NRC06F1213TRF                          |
| 33                                 | 4   | R26, R27, R42, R43                                                   | RES., 100k, 1%, 1/10W, 0603                                          | STACKPOLE ELECTRONICS, INC., RMCF0603FG100K |
| 34                                 | 1   | R35                                                                  | RES., 60.4k, 1%, 1/10W, 0603                                         | NIC, NRC06F6042TRF                          |
| 35                                 | 1   | R36                                                                  | RES., 30.1k, 0.1%, 1/10W, 0603, AEC-Q200                             | PANASONIC, ERA-3AEB3012V                    |
| 36                                 | 6   | R45, R47, R54, R81, R96, R98                                         | RES., 10k, 1%, 1/10W, 0603                                           | VISHAY, CRCW060310K0FKEC                    |
| 37                                 | 5   | R46, R48, R49, R129, R130                                            | RES., 4.99k, 1%, 1/10W, 0603                                         | PANASONIC, ERJ3EKF4991V                     |
| 38                                 | 1   | R52                                                                  | RES., 715k, 1%, 1/10W, 0603                                          | YAGEO, RC0603FR-07715KL                     |
| 39                                 | 1   | R56                                                                  | RES., 590k, 1%, 1/10W, 0603, AEC-Q200                                | PANASONIC, ERJ3EKF5903V                     |

# DEMO MANUAL DC2810A

## PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION                                                       | MANUFACTURER/PART NUMBER      |
|------|-----|-----------|------------------------------------------------------------------------|-------------------------------|
| 40   | 1   | R59       | RES., 402k, 1%, 1/10W, 0603                                            | YAGEO, RC0603FR-07402KL       |
| 41   | 1   | R60       | RES., 787k, 0.1%, 1/10W, 0603, AEC-Q200                                | KOA SPEER, RN73H1JTTD7873B25  |
| 42   | 1   | R80       | RES., 422k, 1%, 1/10W, 0603, AEC-Q200                                  | NIC, NRC06F4223TRF            |
| 43   | 1   | R85       | RES., 249k, 1%, 1/10W, 0603                                            | YAGEO, RC0603FR-07249KL       |
| 44   | 2   | R94, R95  | RES., 0Ω, 1/2W, 1210, AEC-Q200                                         | VISHAY, CRCW12100000Z0EA      |
| 45   | 2   | R97, R99  | RES., 0.01Ω, 1%, 2W, 2512, HIGH PWR, METAL, SENSE, AEC-Q200            | VISHAY, WSL2512R0100FEA18     |
| 46   | 5   | R102-R106 | RES., 200Ω, 1%, 1/10W, 0603                                            | VISHAY, CRCW0603200RFKEA      |
| 47   | 4   | R111-R114 | RES., 127Ω, 1%, 1/10W, 0603, AEC-Q200                                  | NIC, NRC06F1270TRF            |
| 48   | 4   | SW0-SW3   | SWITCH, SLIDE, DPDT, 0.3A, 6VDC, PTH                                   | C&K, JS202011CQN              |
| 49   | 1   | SW4       | SWITCH, TACT, SPST, 0.05A, 12VDC, VERT, 6mm × 3.5mm SMD, BLK, TOP PUSH | ALPS ELECTRIC, SKQMASE010     |
| 50   | 1   | U1        | IC, QUAD OUTPUT DC/D μModule REG., BGA-361                             | ANALOG DEVICES, LTM4673IY#PBF |
| 51   | 1   | U2        | IC, 500mA, LDO μPOWER REG., ADJ., SO-8                                 | ANALOG DEVICES, LT1763CS8#PBF |
| 52   | 1   | U3        | IC, EEPROM, I <sup>2</sup> C, TSSOP-8, 2Kb (256 × 8), 400kHz           | MICROCHIP, 24LC024-I/ST       |

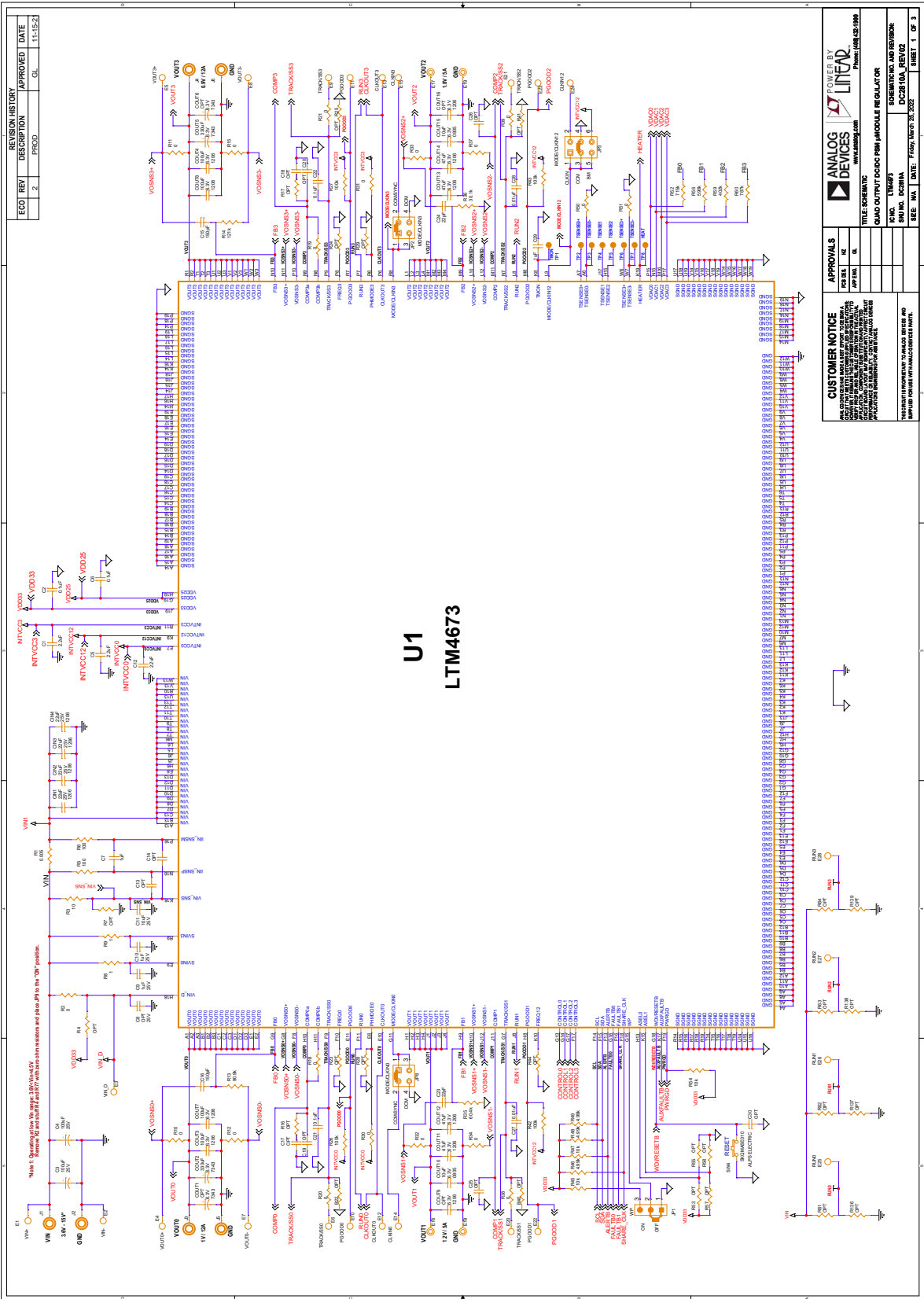
### Additional Demo Board Circuit Components

|   |   |                                                                                                                                                                    |                    |  |
|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--|
| 1 | 0 | C8, C13, C14, C17-C20, C25, C26, C30                                                                                                                               | CAP, OPTION, 0603  |  |
| 2 | 0 | COUT1, COUT6                                                                                                                                                       | CAP, OPTION, 7343  |  |
| 3 | 0 | COUT9, COUT16                                                                                                                                                      | CAP, OPTION, 1206  |  |
| 4 | 0 | R4, R7, R16, R17, R22-R25, R28, R29, R40, R41, R44, R53, R55, R57, R58, R61-R64, R73-R79, R82-R84, R86-R93, R107-R110, R115-R121, R123, R125-R128, R131, R136-R139 | RES., OPTION, 0603 |  |
| 5 | 0 | R71                                                                                                                                                                | RES., OPTION, 2512 |  |
| 6 | 0 | R72                                                                                                                                                                | RES., OPTION, 1206 |  |
| 7 | 0 | R100, R101                                                                                                                                                         | RES., OPTION, 1210 |  |

### Hardware: For Demo Board Only

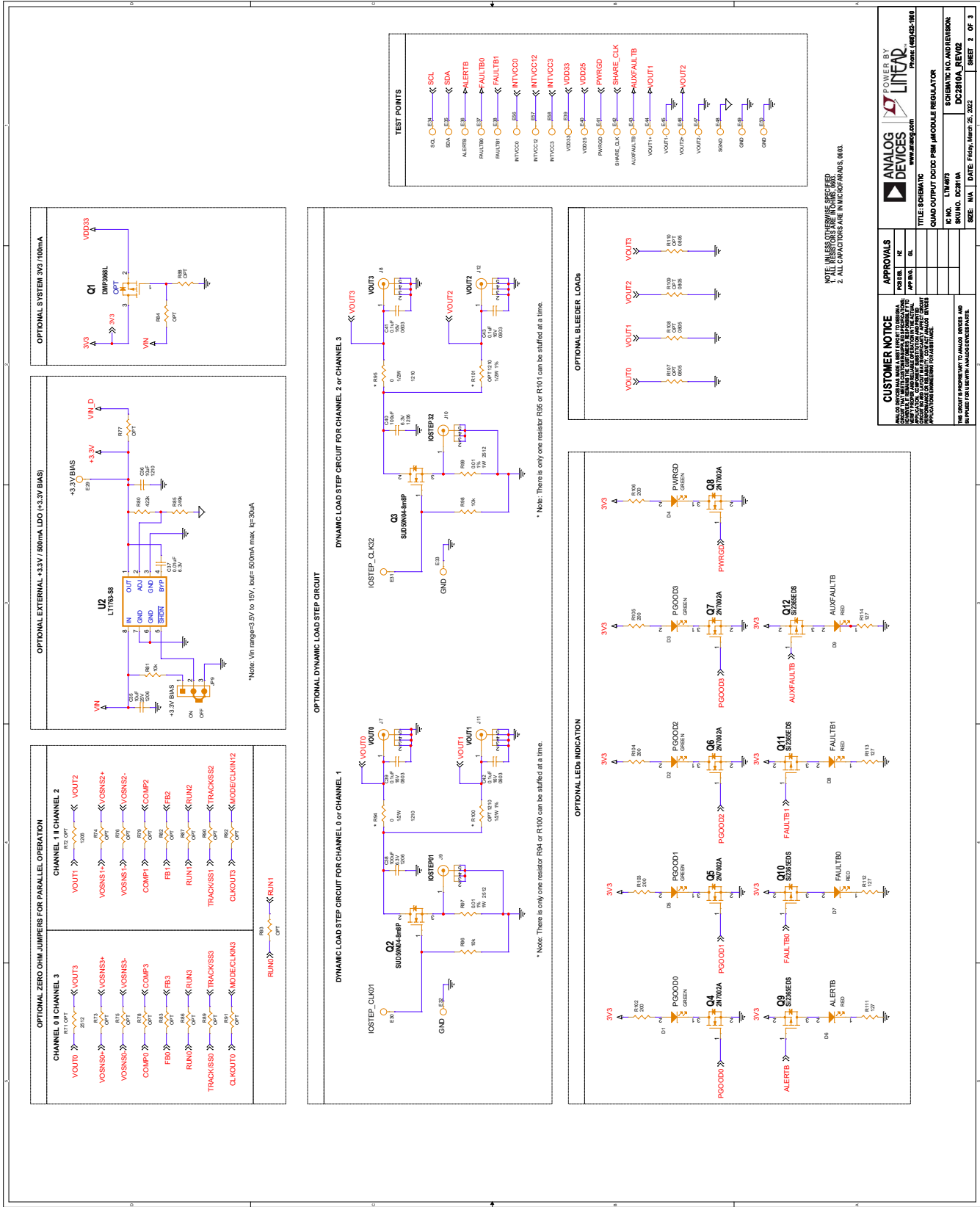
|    |    |                   |                                                               |                                   |
|----|----|-------------------|---------------------------------------------------------------|-----------------------------------|
| 1  | 54 | E1-E15, E20-E58   | TEST POINT, TURRET, 0.064" MTG. HOLE, PCB 0.062" THK          | MILL-MAX, 2308-2-00-80-00-00-07-0 |
| 2  | 4  | E16-E19           | TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK          | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 3  | 6  | J1-J6             | CONN., BANANA JACK, FEMALE, THT, NON INSULATED, SWAGE, 0.218" | KEYSTONE, 575-4                   |
| 4  | 6  | J7-J12            | CONN., RF, BNC, RCPT, JACK, 5-PIN, ST, THT, 50Ω               | AMPHENOL RF, 112404               |
| 5  | 1  | J13               | CONN., HDR, SHROUDED, MALE, 1×4, 2mm, VERT, ST, THT           | HIROSE ELECTRIC, DF3A-4P-2DSA     |
| 6  | 1  | J14               | CONN., HDR, SHROUDED, MALE, 2×6, 2mm, VERT, ST, THT           | AMPHENOL, 98414-G06-12ULF         |
| 7  | 1  | J15               | CONN., HDR, RCPT, FEMALE, 2×10, 2.54mm, R/A, THT              | MILL-MAX, 803-43-020-20-001000    |
| 8  | 1  | J16               | CONN., HDR, MALE, 2×10, 2.54mm, R/A, THT                      | MILL-MAX, 802-40-020-20-001000    |
| 9  | 6  | JP1, JP4-JP7, JP9 | CONN., HDR, MALE, 1×3, 2mm, VERT, ST, THT, NO SUBS. ALLOWED   | SAMTEC, TMM-103-02-L-S            |
| 10 | 2  | JP2, JP8          | CONN., HDR, MALE, 2×2, 2mm, VERT, ST, THT, 10μ Au             | SAMTEC, TMM-102-02-L-D            |
| 11 | 1  | JP3               | CONN., HDR, MALE, 2×3, 2mm, VERT, ST, THT                     | SAMTEC, TMM-103-02-L-D            |
| 12 | 4  | MP1-MP4           | STANDOFF, NYLON, SNAP-ON, 0.25" (6.4mm)                       | KEYSTONE, 8831                    |
| 13 | 9  | XJP1-XJP9         | CONN., SHUNT, FEMALE, 2-POS, 2mm                              | SAMTEC, 2SN-BK-G                  |

SCHEMATIC DIAGRAM



# DEMO MANUAL DC2810A

## SCHEMATIC DIAGRAM







**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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