# LTC3882EUJ-1 High Efficiency Step-Down DC/DC Converter with Power System Management

## DESCRIPTION

Demonstration circuit 2312A is a high current, high efficiency, dual phase synchronous buck converter featuring the LTC3882EUJ-1, a dual output voltage mode controller with the additional features of differential $V_{OUT}$ sense and dedicated PGOOD output on both channels, compared to LTC3882. The LTC3882-1 has the PMBus interface and power system management functions.

There are two versions of the boards available:

- **DC2312A-A:** Dual phase dual output configuration. Default output setting $V_{OUT0}$ = 1.5V/35A, $V_{OUT1}$ = 1.0V/35A.
- **DC2312A-B:** Dual phase single output configuration. Default output setting $V_{OUT0}$ = 1.0V/70A.

The DC2312A powers up to default settings and produces power based on configuration resistors or with its nonvolatile memory without the need for any serial bus communication. This allows easy evaluation of the DC/DC converter. To fully explore the extensive power system management features of the part, download the GUI software LTpowerPlay™ onto your PC and use LTC's $I^2C$/SMBus/PMBus Dongle DC1613A to connect to the board. LTpowerPlay allows the user to reconfigure the part on-the-fly and store the configuration settings within its onboard EEPROM, along with viewing telemetry parameters that include voltage, current, temperature and fault status.

### GUI Software LTpowerPlay Download

The software can be downloaded from:

http://www.linear.com/LTpowerPlay

**Design files for this circuit board are available at http://www.linear.com/demo/DC2312A**



## PERFORMANCE SUMMARY

**Specifications are at $T_A$ = 25°C**

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Input Supply Range | | 7 | 12 | 14 | V |
| $V_{OUT0}$ | Output Voltage Range (-A Version) | $I_{OUT0}$ = 0A to 35A, $V_{IN}$ = 7V to 14V | 0.5 | 1.5 | 2.0* | V |
| $I_{OUT0}$ | Output Current Range (-A Version) | | 0 | | 35** | A |
| $V_{OUT1}$ | Output Voltage Range (-A Version) | $I_{OUT1}$ = 0A to 35A, $V_{IN}$ = 7V to 14V | 0.5 | 1.0 | 2.0* | V |
| $I_{OUT1}$ | Output Current Range (-A Version) | | 0 | | 35** | A |
| $V_{OUT0}$ | Output Voltage Range (-B Version) | $I_{OUT0}$ = 0A to 70A, $V_{IN}$ = 7V to 14V | 0.5 | 1.0 | 2.0* | V |
| $I_{OUT0}$ | Output Current Range (-B Version) | | 0 | | 70** | A |
| $F_{SW}$ | Factory Default Switching (-A Version) | | | 500 | | kHz |
| $F_{SW}$ | Factory Default Switching (-B Version) | | | 450 | | kHz |
| EFFICIENCY | Full Load Efficiency (-A Version) | $V_{OUT0}$ = 1.5V, $I_{OUT0}$ = 35A, See Figure 5 | | 90.6 | | % |
| | | $V_{OUT1}$ = 1.0V, $I_{OUT1}$ = 35A, See Figure 5 | | 88.0 | | % |
| | Full Load Efficiency (-B Version) | $V_{OUT0}$ = 1.0V, $I_{OUT0}$ = 70A, See Figure 6 | | 87.8 | | % |

*Note: The DC2312A uses 2.5V-rated low ESR PosCAP (Part No. 2R5TPE470M7) as output capacitors for optimized load transient performance. If > 2.0V $V_{OUT}$ is needed, 4V or 6.3V-rated output capacitors should be used.

**Note: When continuously running at full load, forced air flow is needed.

## QUICK START PROCEDURE

Demonstration circuit 2312A makes it easy to set up to evaluate the performance of the LTC3882-1. Refer to Figures 2 and 3 for proper measurement equipment setup and follow the procedure below.

**NOTE**. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip directly across the C13 or C39. See Figure 4 for proper scope probe technique.

1. Make sure jumpers are in the following positions:

**DC2312A-A Version**

| JUMPER | POSITION | FUNCTION |
|---|---|---|
| **JP1** | NC | Untie GPIO0B to GPIO1B |
| **JP2** | NC | Untie RUN0 to RUN1 |
| **JP4** | ON | External 5V VDR for DrMOS |
| **JP6** | ON | External 5V $V_{CC}$ for LTC3882-1 |

**DC2312A-B Version**

| JUMPER | POSITION | FUNCTION |
|---|---|---|
| **JP1** | C | Tie GPIO0B to GPIO1B |
| **JP2** | C | Tie RUN0 to RUN1 |
| **JP4** | ON | External 5V VDR for DrMOS |
| **JP6** | ON | External 5V $V_{CC}$ for LTC3882-1 |

2. With power off, connect the input power supply to $V_{IN}$ and GND. Connect active load to the output.
3. Make sure both RUN switches are OFF.
4. Turn on the power at the input.

   **Note.** Make sure that the input voltage does not exceed 15V.
5. Turn on RUN switches as desired.
6. Check for the correct output voltage from $V_{OUT0}^+$ to $V_{OUT0}^-$ and from $V_{OUT1}^+$ to $V_{OUT1}^-$.

   **Note.** If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
7. Once the proper output voltage is established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
8. Connect the dongle and control the output voltages from the GUI. See LTpowerPlay Quick Start Procedure session for details.

## CONNECTING A PC TO DC2312A

You can use a PC to reconfigure the power management features of the LTC3882-1 such as: nominal $V_{OUT}$, margin set points, OV/UV limits, temperature fault limits, sequencing parameters, the fault log, fault responses, GPIO and other functionality. The DC1613A dongle may be plugged in regardless of whether or not $V_{IN}$ is present. Dongle can be hot plugged.

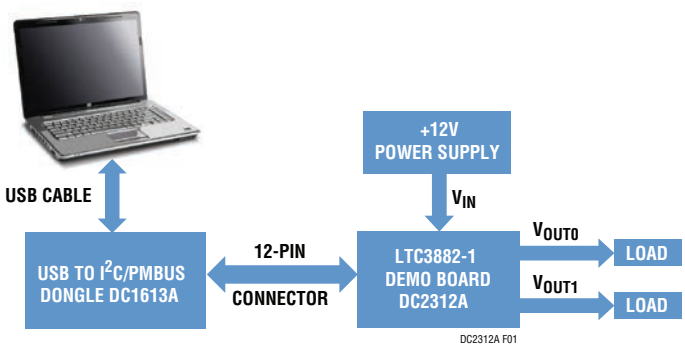



**Figure 1. Demo Setup with PC**

## QUICK START PROCEDURE

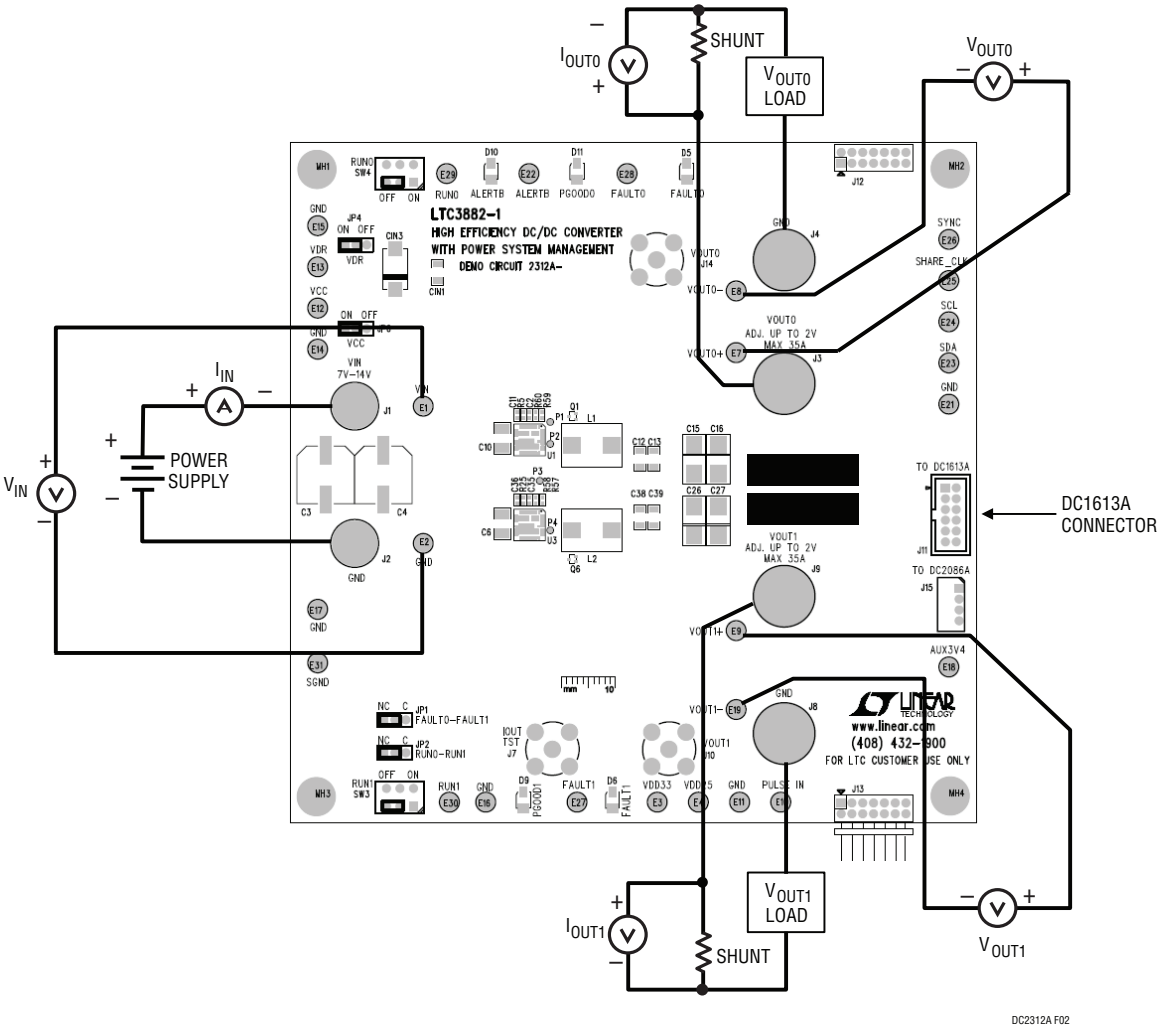



**Figure 2. Power Test Setup for DC2312A-A**

## QUICK START PROCEDURE

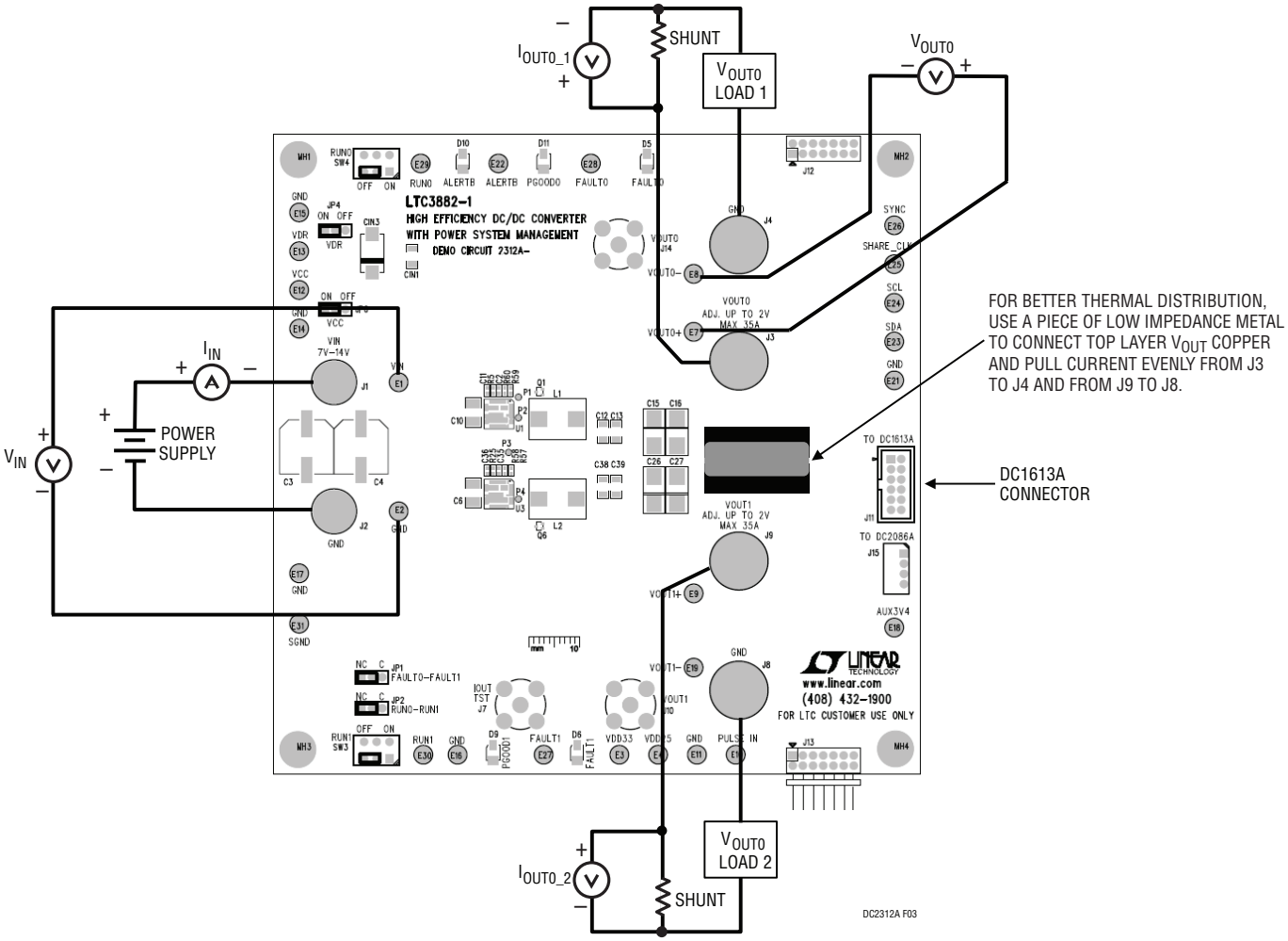



**Figure 3. Power Test Setup for DC2312A-B**

# QUICK START PROCEDURE

## COMBINING DC2312A WITH OTHER DIGITAL POWER DEMO BOARDS

The DC2312A may be plugged together in a multi-board array with other LTC power system management boards using J12 and J13.

## MEASURING OUTPUT RIPPLE VOLTAGE

An accurate ripple measurement may be performed by using the configuration in Figure 4 across C13 or C39.

## MEASURING EFFICIENCY (SEE FIGURES 5 AND 6)

To accurately measure efficiency of any configuration, do the following:

- Set JP4 and JP6 on the "OFF" position.
- Connect external 5V supply to VDR and $V_{CC}$ turrets and measure its input current.
- Measure $V_{IN}$ across the input ceramic capacitor (C10, C6). Measure $V_{OUT}$ across the output ceramic capacitor (C13, C39).
- Add the loss from external 5V supply into the efficiency calculation.

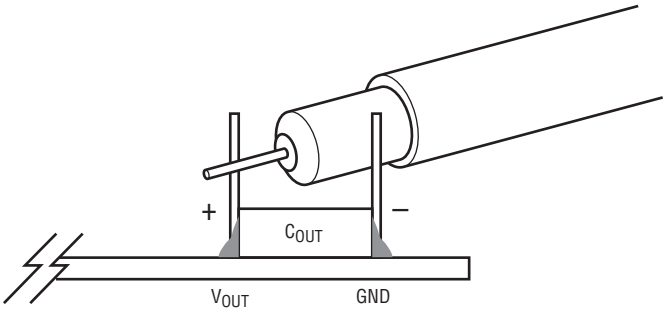



**Figure 4. Measuring Output Voltage Ripple**

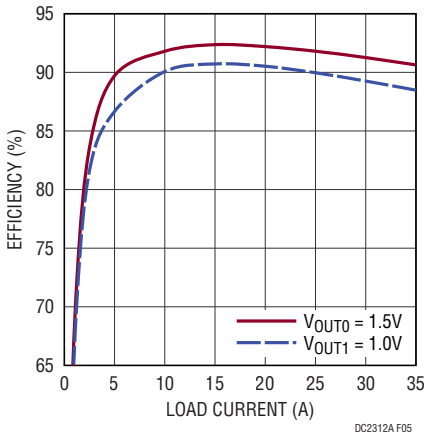



**Figure 5. DC2312A-A, Typical Efficiency Curves, $V_{IN}$ = 12V, $F_{SW}$ = 500kHz, CCM**

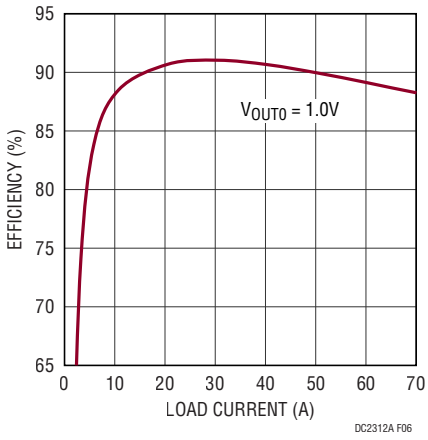



**Figure 6. DC2312A-B, Typical Efficiency Curves, $V_{IN}$ = 12V, $F_{SW}$ = 450kHz, CCM**

## QUICK START PROCEDURE

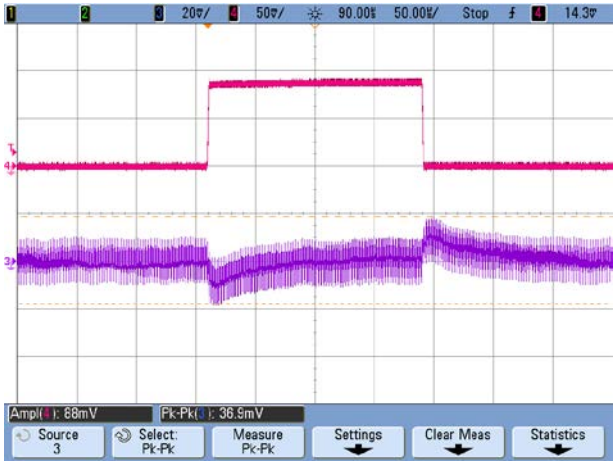



Figure 7. Load Transient Waveform DC2312A-A, $V_{IN}$ = 12V, $V_{OUT0}$ = 1.5V, $F_{SW}$ = 500kHz, 0% to 25% (8.75A) Load Step

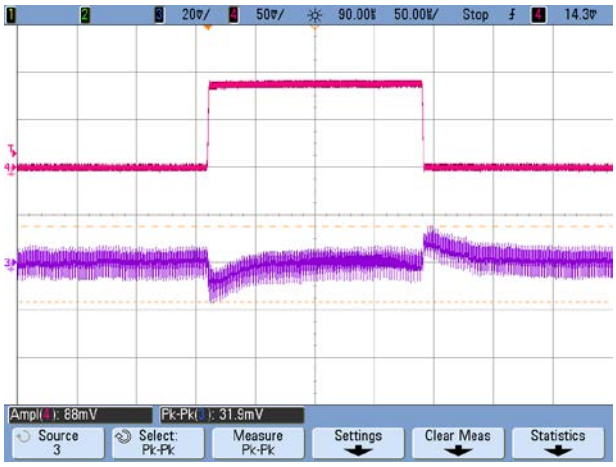



Figure 8. Load Transient Waveform DC2312A-A, $V_{IN}$ = 12V, $V_{OUT1}$ = 1.0V, $F_{SW}$ = 500kHz, 0% to 25% (8.75A) Load Step

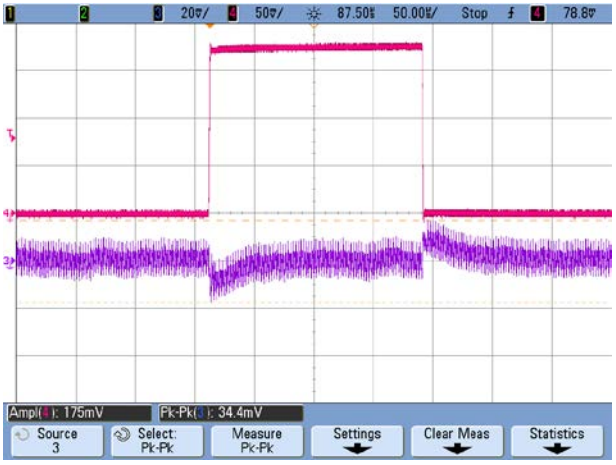



Figure 9. Load Transient Waveform DC2312A-B, $V_{IN}$ = 12V, $V_{OUT0}$ = 1.0V, $F_{SW}$ = 450kHz, 0% to 25% (17.5A) Load Step

## QUICK START PROCEDURE

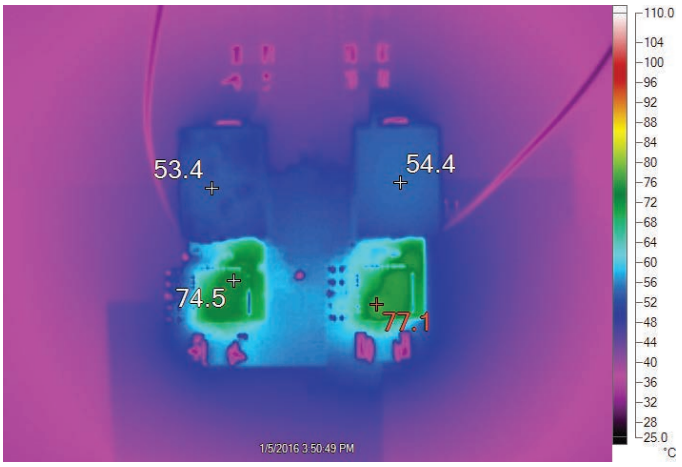



**Figure 10. Thermal Picture of DC2312A-A, $V_{IN}$ = 12V, $V_{OUT0}$ = 1.5V/35A, $V_{OUT1}$ = 1.0V/35A, $f_{SW}$ = 500kHz, 400LFM Air Flow**

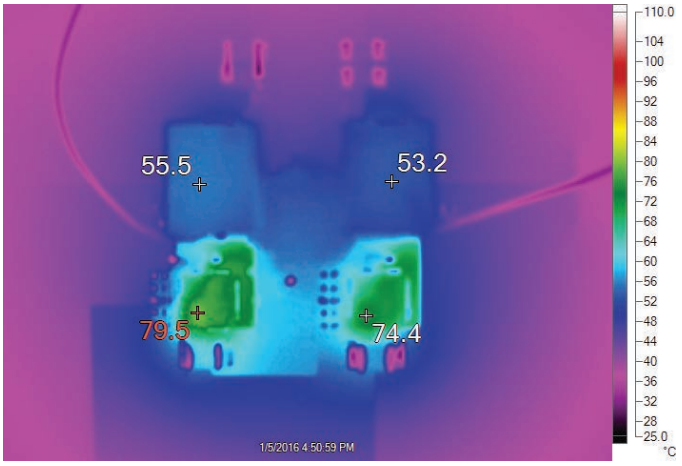



**Figure 11. Thermal Picture of DC2312A-B, $V_{IN}$ = 12V, $V_{OUT0}$ = 1.0V/70A, $f_{SW}$ = 450kHz, 400LFM Air Flow**

## LTpowerPlay SOFTWARE GUI

LTpowerPlay is a powerful Windows-based development environment that supports Linear Technology power system management ICs, including the LTC3880, LTC3882/LTC3882-1, LTC3883, LTM4676A, LTC2974 and the LTC2978. The software supports a variety of different tasks. You can use LTpowerPlay to evaluate Linear Technology ICs by connecting to a demo board system. LTpowerPlay can also be used in an offline mode (with no hardware present) in order to build a multi-chip configuration file that can be saved and reloaded at a later time. LTpowerPlay provides unprecedented 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 DC1613A USB-to-SMBus controller to communicate with one of many potential targets, including the LTC3882-1's DC2312A 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. The LTpowerPlay software can be downloaded from:

http://www.linear.com/LTpowerPlay

To access technical support documents for LTC Digital Power Products visit Help. View online help on the LTpowerPlay menu.

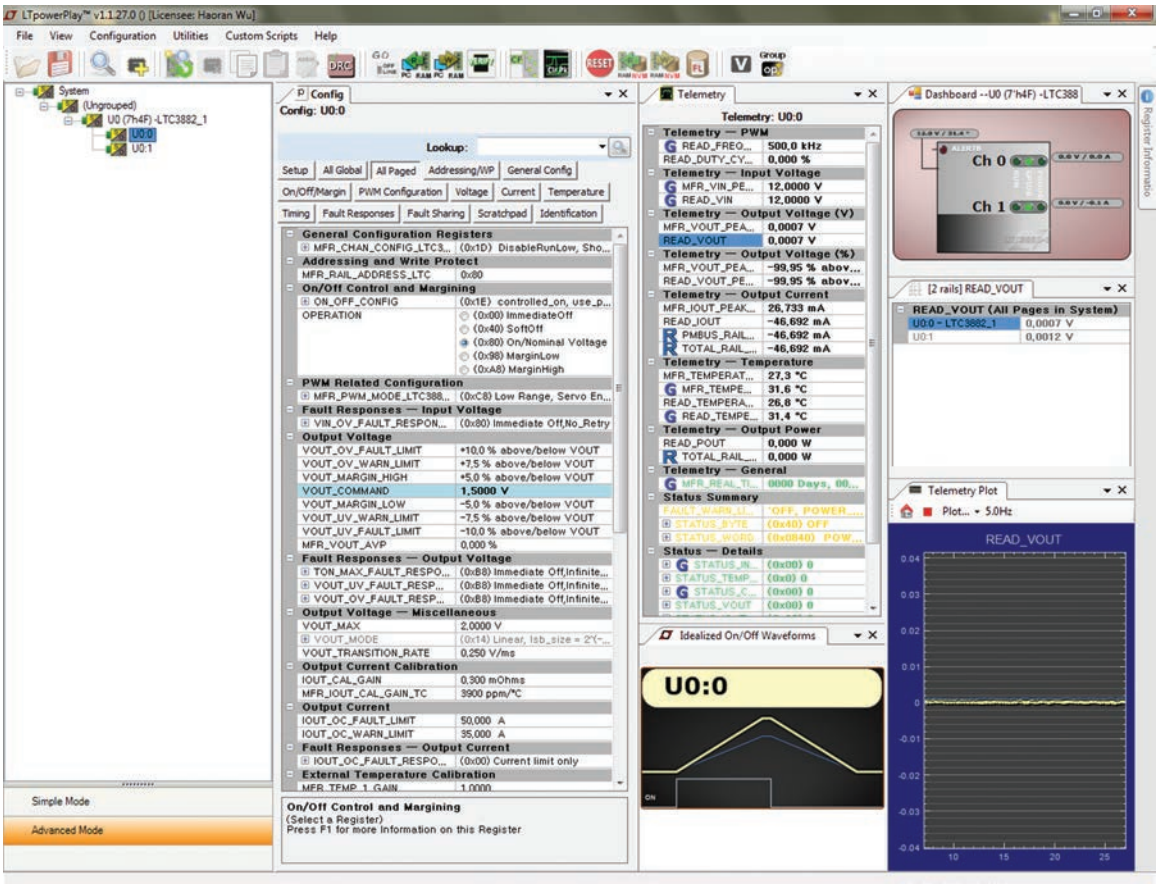



**Figure 12. LTpowerPlay Main Interface**

## LTpowerPlay QUICK START PROCEDURE

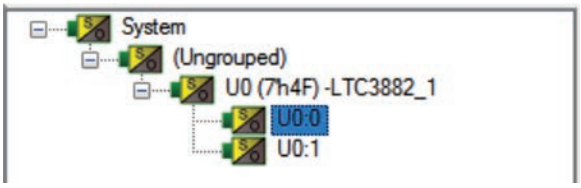
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTC3882-1 (taking DC2312A-A as an example).

1. Download and install the LTPowerPlay GUI:

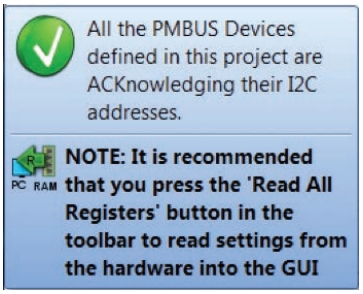
   http://www.linear.com/LTpowerPlay

2. Launch the LTpowerPlay GUI.

   a. The GUI should automatically identify the DC2312A-A. The system tree on the left hand side should look like this:

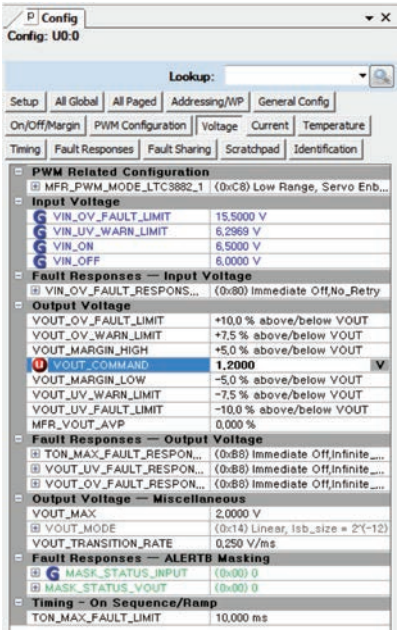



   b. A blue message box shows for a few seconds in the lower left hand corner, confirming that the LTC3882-1 is communicating:



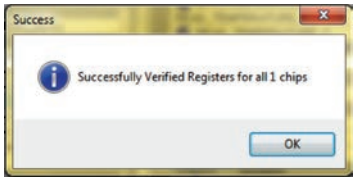

   c. In the Toolbar, click the “R” (RAM to PC) icon to read the RAM from the LTC3882-1. This reads the configuration from the RAM of LTC3882-1 and loads it into the GUI:


   d. If you want to change the output voltage to a different value, like 1.2V. In the Config tab, type in 1.2 in the VOUT_COMMAND box, like this:




   Then, click the “W” (PC to RAM) icon to write these register values to the LTC3882-1. After finishing this step, you will see the output voltage will change to 1.2V.


   If the write is successful, you will see the following message:




   e. You can save the changes into the NVM. In the tool bar, click “RAM to NVM” button, as following:


   f. Save the demo board configuration to a (*.proj) file. Click the Save icon and save the file with a new name.

## PARTS LIST DC2312A-A

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components** | | | | |
| 1 | 3 | C5, C52, C53 | CAP., X7R, 0.1µF, 16V, 10%, 0402 | AVX, 0402YC104KAT2A |
| 2 | 3 | CF, COUT4, COUT5 | CAP., X7R, 0.1uF, 16V, 10%, 0603 | AVX, 0603YC104KAT2A |
| 3 | 2 | CFFW1, CFFW2 | CAP., NP0, 22pF, 25V, 10%, 0402 | AVX, 04023A220KAT2A |
| 4 | 1 | CIN1 | CAP., X5R, 10µF, 25V, 20%, 1206 | AVX, 12063D106MAT2A |
| 5 | 2 | COUT3, COUT7 | CAP., X5R, 10µF, 16V, 10%, 0805 | AVX, 0805YD106KAT2A |
| 6 | 1 | CIN3 | CAP., TANT, 22µF, 35V, 20%, 7343 | AVX, TCME226M035R0025 |
| 7 | 4 | C6, C10, C33, C34 | CAP., X5R, 22µF, 25V, 10%, 1210 | MURATA, GRM32ER61E226KE15L |
| 8 | 6 | C1, C2, C8, C31, C35, C9 | CAP., X5R, 1µF, 10V, 20%, 0402 | MURATA, GRM155R61A105ME15D |
| 9 | 1 | C7 | CAP., X5R, 2.2µF, 10V, 20%, 0402 | Taiyo Yuden, LMK105BJ225MV-F |
| 10 | 3 | C47, C57, C58 | CAP., X5R, 1µF, 16V, 10%, 0805 | AVX, 0805YD105KAT2A |
| 11 | 2 | C3, C4 | CAP., OS-CON, 330µF, 16V, 20%, F12 | PANASONIC, 16SVP330M |
| 12 | 2 | C11, C36, | CAP., X7R, 100nF, 16V, 10%, 0402 | MURATA, GRM155R71C104KA88D |
| 13 | 1 | C45 | CAP., X7R, 100nF, 16V, 10%, 0603 | TDK, C1608X7R1C404KT000N |
| 14 | 8 | C12, C13, C14, C23, C38, C39, C40, C43 | CAP., X5R, 100µF, 6.3V, 20%, 1206 | MURATA, GRM31CR60J107ME39L |
| 15 | 8 | C15, C16, C26, C27, C17, C18, C19, C28 | CAP., POSCAP, 470µF, 2.5V, D2E SIZE | PANASONIC, EEFGX0E471R |
| 16 | 2 | L1, L2 | IND., 0.17µH | COOPER., FP1007R3-R17-R |
| 17 | 1 | R1 | RES., CHIP, 1,  1%, 0402 | VISHAY, CRCW04021R00FKED |
| 18 | 2 | R2, R15 | RES., CHIP, 24.9k, 1%, 0402 | VISHAY, CRCW040224K9FKED |
| 19 | 2 | R93, R94 | RES., CHIP, 200, 1%, 0603 | VISHAY, CRCW0603200RFKED |
| 20 | 3 | R80, R81, R84 | RES., CHIP, 127, 1%, 0603 | VISHAY, CRCW0603127RFKEA |
| 21 | 1 | R87 | RES., CHIP, 15.8k, 1%, 0603 | VISHAY, CRCW060315K8FKEA |
| 22 | 2 | U1, U3 | IC, HIGH FREQUENCY DrMOS MOUDLE | FAIRCHILD, FDMF5820DC |
| 23 | 1 | U2 | IC, LTC3882EUJ-1, QFN 6mm × 6mm | LINEAR TECH., LTC3882EUJ-1#0134-1PBF |
| 24 | 1 | U5 | IC EEPROM 2KBIT 400kHz 8 TSSOP | MICROCHIP, 24LC025-I/ST |
| 25 | 1 | U6 | IC., LTC3607EMSE, 16 Pin QFM  3mm × 3mm | LINEAR TECH., LTC3607IMSE#PBF |
| 26 | 1 | R20 | RES., CHIP, 53.6k, 1%, 0402 | VISHAY, CRCW040253K6FKED |
| 27 | 1 | C50 | CAP., NP0, 10pF, 25V, 10%, 0402 | AVX, 04023A100KAT2A |
| 28 | 1 | C54 | CAP., X7R, 220pF, 50V, 10%, 0402 | MURATA, GRM155R71H221KA01D |
| 29 | 2 | C21, C55 | CAP., X7R,680pF, 50V, 10%, 0402 | MURATA, GRM155R71H681KA01D |

## PARTS LIST DC2312A-A

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 0 | D4, D7 (OPT) | OPTIONAL | |
| 2 | 2 | C20, C42 | CAP., X5R, 0.22µF, 16V, 10%, 0402 | TDK, C1005X5R1C224K |
| 3 | 1 | C22 | CAP., X7R, 220pF, 50V, 10%, 0402 | MURATA, GRM155R71H221KA01D |
| 4 | 2 | C29, C44 | CAP., X7R, 0.01µF, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 5 | 2 | C32, C48 | CAP., X7R, 0.01µF, 16V, 10%, 0402 | AVX, 0402YC103KAT2A |
| 6 | 1 | C30 | CAP., NP0, 10pF, 25V, 10%, 0402 | AVX, 04023A100KAT2A |
| 7 | 2 | D9, D11 | LED, GREEN RECT CLEAR 0603 | LITE ON, LTST-C193KGKT-5A |
| 8 | 3 | D5, D6, D10 | LED, RED RECT CLEAR 0603 | LITE ON, LTST-C193KRKT-5A |
| 9 | 1 | D8 | DIODE, ULTRA LOW SCHOTTKY RECTIEIER | NXP SEMI. PMEG2005AEL,315 |
| 10 | 2 | L3, L4 | IND., 4.7µH | VISHAY, IHLP1616BZER4R7M11 |
| 11 | 2 | Q1, Q6 | TRANS, PNP GP 40V 200MA SC75-3 | ON SEMI, MMBT3906TT1G |
| 12 | 1 | Q3 | MOSFET, SPEED SRS 30V 30A LFPAK | RENESAS, RJK0305DPB-00#J0 |
| 13 | 4 | Q19, Q20, Q21, Q22 | MOSFET, P-CH 20V 5.9A SOT-23 | VISHAY, Si2365EDS-T1-GE3 |
| 14 | 2 | Q23, Q24 | MOSFET, N-CH 60V 115MA SOT23 | DIODES INC., 2N7002-7-F |
| 15 | 1 | RF | RES., CHIP, 100, 1%, 0402 | VISHAY, CRCW0402100RFKED |
| 16 | 2 | RPG1, RPG2 | RES., CHIP, 100k, 1%, 0402 | VISHAY, CRCW0402100KFKED |
| 17 | 2 | RSD1, RSD2 | RES., CHIP, 5.1M, 5%, 0402 | VISHAY, CRCW04025M10JNED |
| 18 | 2 | R5, R25 | RES., CHIP, 0, 0402 | VISHAY, CRCW04020000Z0ED |
| 19 | 5 | R16, R24, R71, R73, R83 | RES., CHIP, 0, 0603 | VISHAY, CRCW06030000Z0EA |
| 20 | 1 | R45 | SENSE RES., 0.010Ω 1W 1% 2512 | PANASONIC, ERJ-M1WSF10MU |
| 21 | 1 | R48 | SENSE RES., 0.001Ω 1W 1% 2512 | PNANSONIC, ERJ-M1WTF1M0U |
| 22 | 0 | R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R53, R68, R72, R74, R75, R78, R82, R90, R91, R92 (OPT) | OPTIONAL | |
| 23 | 2 | R7, R27 | RES., CHIP, 2.67k, 1%, 0402 | VISHAY, CRCW04022K67FKED |
| 24 | 1 | R9 | RES., CHIP, 1.24k, 1%, 0402 | VISHAY, CRCW04021K24FKED |
| 25 | 13 | R10, R11, R13, R14, R17, R19, R21, R28, R41, R42, R43, R44, R86 | RES., CHIP, 10k, 1%, 0603 | VISHAY, CRCW060310K0FKEA |
| 22 | 1 | R12 | RES., CHIP, 53.6k, 1%, 0402 | VISHAY, CRCW040253K6FKED |
| 23 | 4 | R57, R58, R59, R60 | RES., CHIP, 1k, 1%, 0402 | VISHAY, CRCW04021K00FKED |
| 24 | 2 | R63, R65 | RES., CHIP, 121k, 1%, 0402 | VISHAY, CRCW0402121KFKED |
| 25 | 2 | R64, R66 | RES., CHIP, 887k, 1%, 0402 | VISHAY, CRCW0402887KFKED |
| 26 | 2 | R69, R70 | RES., CHIP, 10, 1%, 0603 | VISHAY, CRCW060310R0FKEA |
| 27 | 2 | R76, R77 | RES., CHIP, 4.99k, 1%, 0603 | VISHAY, CRCW06034K99FKEA |
| 28 | 0 | R62, R67, R98, R99, R101 | OPTIONAL | |
| 29 | 0 | R61, R100 | OPTIONAL | |
| 30 | 2 | R22, R46 | RES., CHIP, 0, 0603 | VISHAY, CRCW06030000Z0EA |
| 31 | 0 | C37, C41 | OPTIONAL | |
| 32 | 1 | R18 | RES., CHIP, 1.24k, 1%, 0402 | VISHAY, CRCW04021K24FKED |
| 33 | 0 | R49 | OPTIONAL | |

## PARTS LIST DC2312A-A

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Hardware – For Demo Board Only** | | | | |
| 1 | 28 | E1-E4, E7-E19, E21-E31 | TESTPOINT, TURRET, .094" | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2 | 2 | J1, J2 | BANANA SMALL | KEYSTONE, 575-4 |
| 3 | 4 | J3, J4, J8, J9 | STUD, TESTPIN | PEM, KFH-032-10 |
| 4 | 8 | J3, J4, J8, J9 ( X2 ) | NUT, BRASS 10-32 | ANY #10-32M/S BR PL |
| 5 | 4 | J3, J4, J8, J9 | RING, LUG #10 | KEYSTONE, 8205 |
| 6 | 4 | J3, J4, J8, J9 | WASHER, TIN PLATED BRASS | ANY #10 EXT BZ TN |
| 7 | 4 | JP1, JP2, JP4, JP6 | HEADER, 3 PIN 0.079 SINGLE ROW | WURTH, 620 003 111 21 |
| 8 | 4 | JP1, JP2, JP4, JP6 | SHUNT | SAMTEC, 2SN-BK-G |
| 9 | 2 | SW3, SW4 | CONNECTOR, SUB MINIATURE SLIDE SWITCHES | C&K.,JS202011CQN |
| 10 | 3 | J7, J10, J14 | CONN., BNC PC MOUNT RECEPT. JACK, 50Ω, TF-4 POST | CONNEX, 112404 |
| 11 | 1 | J11 | HEADER 12POS 2MM STR DL PCB | FCI, 98414-G06-12ULF |
| 12 | 1 | J12 | CONN., HEADER, 2X7, 2mm, R/A (F) | SULLINS, NPPN072FJFN-RC |
| 13 | 1 | J13 | CONN., HEADER, 2X7, 2mm, R/A (M) | MOLEX, 87760-1416 |
| 14 | 1 | J15 | HEADER, 4 PINS, SHROUDED | HIROSE, DF3A-4P-2DSA |

## PARTS LIST DC2312A-B

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components** | | | | |
| 1 | 3 | C5, C52, C53 | CAP., X7R, 0.1µF, 16V, 10%, 0402 | AVX, 0402YC104KAT2A |
| 2 | 3 | CF, COUT4, COUT5 | CAP., X7R, 0.1µF, 16V, 10%, 0603 | AVX, 0603YC104KAT2A |
| 3 | 2 | CFFW1, CFFW2 | CAP., NP0, 22pF, 25V, 10%, 0402 | AVX, 04023A220KAT2A |
| 4 | 1 | CIN1 | CAP., X5R, 10µF, 25V, 20%, 1206 | AVX, 12063D106MAT2A |
| 5 | 2 | COUT3,COUT7 | CAP., X5R, 10µF, 16V, 10%, 0805 | AVX, 0805YD106KAT2A |
| 6 | 1 | CIN3 | CAP., TANT, 22µF, 35V, 20%, 7343 | AVX, TCME226M035R0025 |
| 7 | 4 | C6, C10, C33, C34 | CAP., X5R, 22µF, 25V, 10%, 1210 | MURATA, GRM32ER61E226KE15L |
| 8 | 6 | C1, C2, C8, C31, C35, C9 | CAP., X5R, 1µF, 10V, 20%, 0402 | MURATA, GRM155R61A105ME15D |
| 9 | 1 | C7 | CAP., X5R, 2.2µF, 10V, 20%, 0402 | Taiyo Yuden, LMK105BJ225MV-F |
| 10 | 3 | C47, C57, C58 | CAP., X5R, 1µF, 16V, 10%, 0805 | AVX, 0805YD105KAT2A |
| 11 | 2 | C3, C4 | CAP., OS-CON, 330µF, 16V, 20%, F12 | PANASONIC, 16SVP330M |
| 12 | 2 | C11, C36 | CAP., X7R, 100nF, 16V, 10%, 0402 | MURATA, GRM155R71C104KA88D |
| 13 | 1 | C45 | CAP., X7R, 100nF, 16V, 10%, 0603 | TDK, C1608X7R1C404KT000N |
| 14 | 8 | C12, C13, C14, C23, C38, C39, C40, C43 | CAP., X5R, 100µF, 6.3V, 20%, 1206 | MURATA, GRM31CR60J107ME39L |
| 15 | 8 | C15, C16, C26, C27, C17, C18, C19, C28 | CAP., POSCAP, 470µF, 2.5V, D2E SIZE | PANASONIC, EEFGX0E471R |
| 16 | 2 | L1, L2 | IND., 0.17µH | COOPER., FP1007R3-R17-R |
| 17 | 1 | R1 | RES., CHIP, 1, 1%, 0402 | VISHAY, CRCW04021R00FKED |
| 18 | 2 | R2, R15 | RES., CHIP, 24.9k, 1%, 0402 | VISHAY, CRCW040224K9FKED |
| 19 | 2 | R93, R94 | RES., CHIP, 200, 1%, 0603 | VISHAY, CRCW0603200RFKED |
| 20 | 3 | R80, R81, R84 | RES., CHIP, 127, 1%, 0603 | VISHAY, CRCW0603127RFKEA |
| 21 | 1 | R87 | RES., CHIP, 15.8k, 1%, 0603 | VISHAY, CRCW060315K8FKEA |
| 22 | 2 | U1, U3 | IC, HIGH FREQUENCY DrMOS MOUDLE | FAIRCHILD, FDMF5820DC |
| 23 | 1 | U2 | IC, LTC3882EUJ-1, QFN 6mm × 6mm | LINEAR TECH., LTC3882EUJ-1#0315-1PBF |
| 24 | 1 | U5 | IC EEPROM 2KBIT 400kHz 8TSSOP | MICROCHIP, 24LC025-I/ST |
| 25 | 1 | U6 | IC., LTC3607EMSE, 16 Pin QFM 3 × 3mm | LINEAR TECH., LTC3607IMSE#PBF |
| 26 | 2 | C37, C41 | CAP., NP0, 22pF, 25V, 10%, 0402 | AVX, 04023A220KAT2A |
| 27 | 1 | R49 | RES., CHIP, 0, 2512, 1W | VISHAY, CRCW25120000Z0EG |
| 28 | 1 | C21 | CAP., X7R, 470pF, 50V, 10%, 0402 | MURATA, GRM155R71H471KA01D |

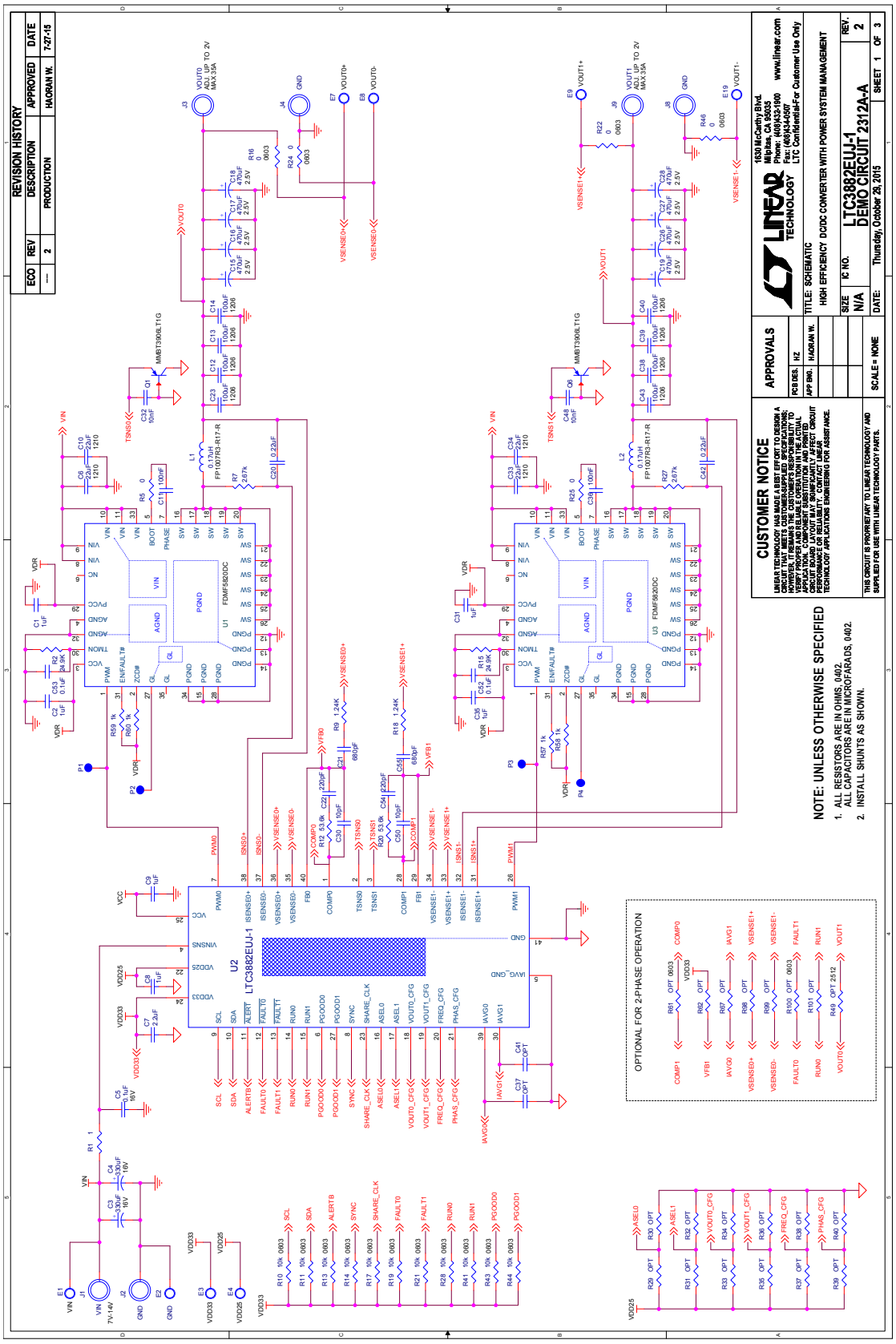
## PARTS LIST DC2312A-B

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 0 | D4, D7 (OPT) | OPTIONAL | |
| 2 | 2 | C20, C42 | CAP., X5R, 0.22µF, 16V, 10%, 0402 | TDK, C1005X5R1C224K |
| 3 | 1 | C22 | CAP., X7R, 220pF, 50V, 10%, 0402 | MURATA, GRM155R71H221KA01D |
| 4 | 2 | C29, C44 | CAP., X7R, 0.01µF, 16V, 10%, 0603 | AVX, 0603YC103KAT2A |
| 5 | 2 | C32, C48 | CAP., X7R, 0.01µF, 16V, 10%, 0402 | AVX, 0402YC103KAT2A |
| 6 | 1 | C30 | CAP., NP0, 10pF, 25V, 10%, 0402 | AVX, 04023A100KAT2A |
| 7 | 2 | D9, D11 | LED, GREEN RECT CLEAR 0603 | LITE ON, LTST-C193KGKT-5A |
| 8 | 3 | D5, D6, D10 | LED, RED RECT CLEAR 0603 | LITE ON, LTST-C193KRKT-5A |
| 9 | 1 | D8 | DIODE, ULTRA LOW SCHOTTKY RECTIFIER | NXP SEMI. PMEG2005AEL,315 |
| 10 | 2 | L3, L4 | IND., 4.7µH | VISHAY, IHLP1616BZER4R7M11 |
| 11 | 2 | Q1, Q6 | TRANS, PNP GP 40V 200MA SC75-3 | ON SEMI, MMBT3906TT1G |
| 12 | 1 | Q3 | MOSFET, SPEED SRS 30V 30A LFPAK | RENESAS, RJK0305DPB-00#J0 |
| 13 | 4 | Q19, Q20, Q21, Q22 | MOSFET, P-CH 20V 5.9A SOT-23 | VISHAY, Si2365EDS-T1-GE3 |
| 14 | 2 | Q23, Q24 | MOSFET, N-CH 60V 115MA SOT23 | DIODES INC., 2N7002-7-F |
| 15 | 1 | RF | RES., CHIP, 100, 1%, 0402 | VISHAY, CRCW0402100RFKED |
| 16 | 2 | RPG1, RPG2 | RES., CHIP, 100k, 1%, 0402 | VISHAY, CRCW0402100KFKED |
| 17 | 2 | RSD1, RSD2 | RES., CHIP, 5.1M, 5%, 0402 | VISHAY, CRCW04025M10JNED |
| 18 | 2 | R5, R25 | RES., CHIP, 0, 0402 | VISHAY, CRCW04020000Z0ED |
| 19 | 5 | R16, R24, R71, R73, R83 | RES., CHIP, 0, 0603 | VISHAY, CRCW06030000Z0EA |
| 20 | 1 | R45 | SENSE RES., 0.010Ω, 1W, 1%, 2512 | PANASONIC, ERJ-M1WSF10MU |
| 21 | 1 | R48 | SENSE RES., 0.001Ω, 1W, 1%, 2512 | PNANSONIC, ERJ-M1WTF1M0U |
| 22 | 0 | R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R53, R68, R72, R74, R75, R78, R82, R90, R91, R92 (OPT) | OPTIONAL | |
| 23 | 2 | R7, R27 | RES., CHIP, 2.67k, 1%, 0402 | VISHAY, CRCW04022K67FKED |
| 24 | 1 | R9 | RES., CHIP, 1.24k, 1%, 0402 | VISHAY, CRCW04021K24FKED |
| 25 | 13 | R10, R11, R13, R14, R17, R19, R21, R28, R41, R42, R43, R44, R86 | RES., CHIP, 10k, 1%, 0603 | VISHAY, CRCW060310K0FKEA |
| 22 | 1 | R12 | RES., CHIP, 64.9k, 1%, 0402 | VISHAY, CRCW040264K9FKED |
| 23 | 4 | R57, R58, R59, R60 | RES., CHIP, 1k, 1%, 0402 | VISHAY, CRCW04021K00FKED |
| 24 | 2 | R63, R65 | RES., CHIP, 121k, 1%, 0402 | VISHAY, CRCW0402121KFKED |
| 25 | 2 | R64, R66 | RES., CHIP, 887k, 1%, 0402 | VISHAY, CRCW0402887KFKED |
| 26 | 2 | R69, R70 | RES., CHIP, 10, 1%, 0603 | VISHAY, CRCW060310R0FKEA |
| 27 | 2 | R76, R77 | RES., CHIP, 4.99k, 1%, 0603 | VISHAY, CRCW06034K99FKEA |
| 28 | 5 | R62, R67, R98, R99, R101 | RES., CHIP, 0, 0402 | VISHAY, CRCW04020000Z0ED |
| 29 | 2 | R61, R100 | RES., CHIP, 0, 0603 | VISHAY, CRCW06030000Z0EA |
| 30 | 0 | R22, R46 | OPTIONAL | |
| 31 | 0 | R18 | OPTIONAL | |
| 32 | 0 | R20 | OPTIONAL | |
| 33 | 0 | C50 | OPTIONAL | |
| 34 | 0 | C54 | OPTIONAL | |
| 35 | 0 | C55 | OPTIONAL | |

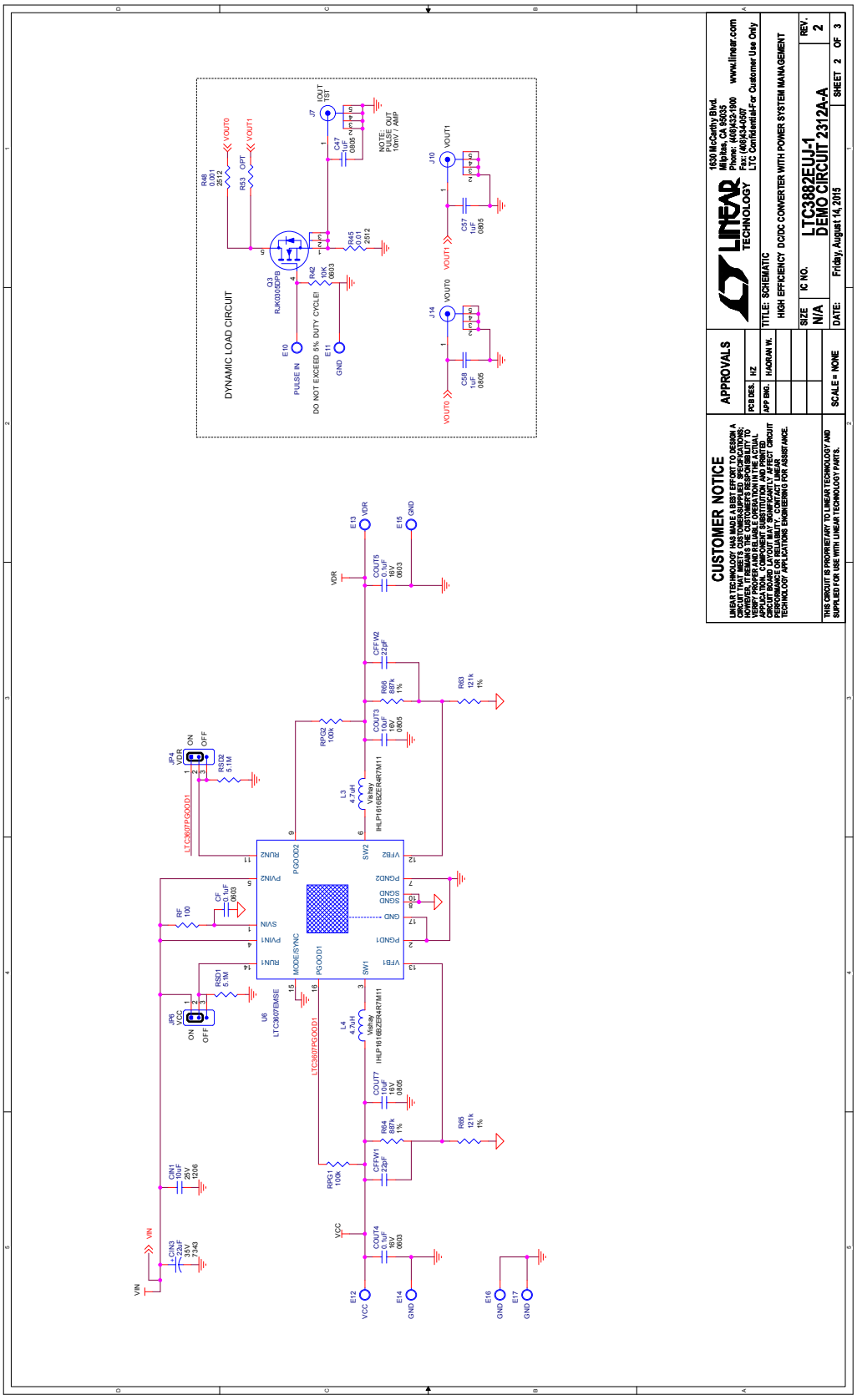
## PARTS LIST DC2312A-B

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Hardware – For Demo Board Only** | | | | |
| 1 | 28 | E1-E4, E7-E19, E21-E31 | TESTPOINT, TURRET, .094" | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2 | 2 | J1, J2 | BANANA SMALL | KEYSTONE, 575-4 |
| 3 | 4 | J3, J4, J8, J9 | STUD, TEST PIN | PEM, KFH-032-10 |
| 4 | 8 | J3, J4, J8, J9 ( X2 ) | NUT, BRASS 10-32 | ANY #10-32M/S BR PL |
| 5 | 4 | J3, J4, J8, J9 | RING, LUG #10 | KEYSTONE, 8205 |
| 6 | 4 | J3, J4, J8, J9 | WASHER, TIN PLATED BRASS | ANY #10 EXT BZ TN |
| 7 | 4 | JP1, JP2, JP4, JP6 | HEADER, 3 PIN 0.079 SINGLE ROW | WURTH, 620 003 111 21 |
| 8 | 4 | JP1, JP2, JP4, JP6 | SHUNT | SAMTEC, 2SN-BK-G |
| 9 | 2 | SW3, SW4 | CONNECTOR, SUB MINIATURE SLIDE SWITCHES | C&K.,JS202011CQN |
| 10 | 3 | J7, J10, J14 | CONN., BNC PC MOUNT RECEPT. JACK, 50Ω, TF-4 POST | CONNEX, 112404 |
| 11 | 1 | J11 | HEADER 12POS 2MM STR DL PCB | FCI, 98414-G06-12ULF |
| 12 | 1 | J12 | CONN., HEADER, 2mm × 7mm, 2mm, R/A (F) | SULLINS, NPPN072FJFN-RC |
| 13 | 1 | J13 | CONN., HEADER, 2mm × 7mm, 2mm, R/A (M) | MOLEX, 87760-1416 |
| 14 | 1 | J15 | HEADER, 4 PINS, SHROUDED | HIROSE, DF3A-4P-2DSA |

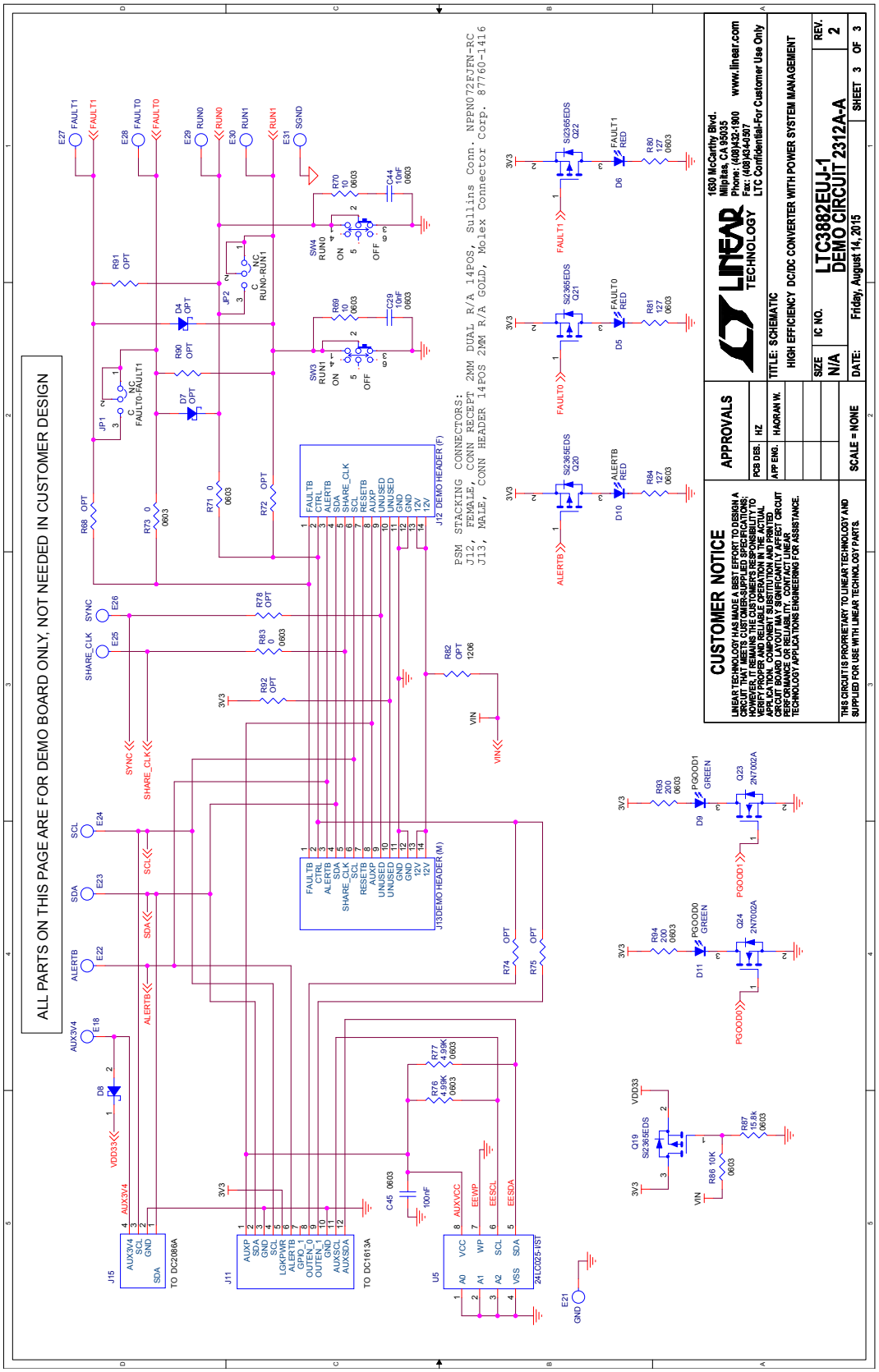
## SCHEMATIC DIAGRAM DC2312A-A



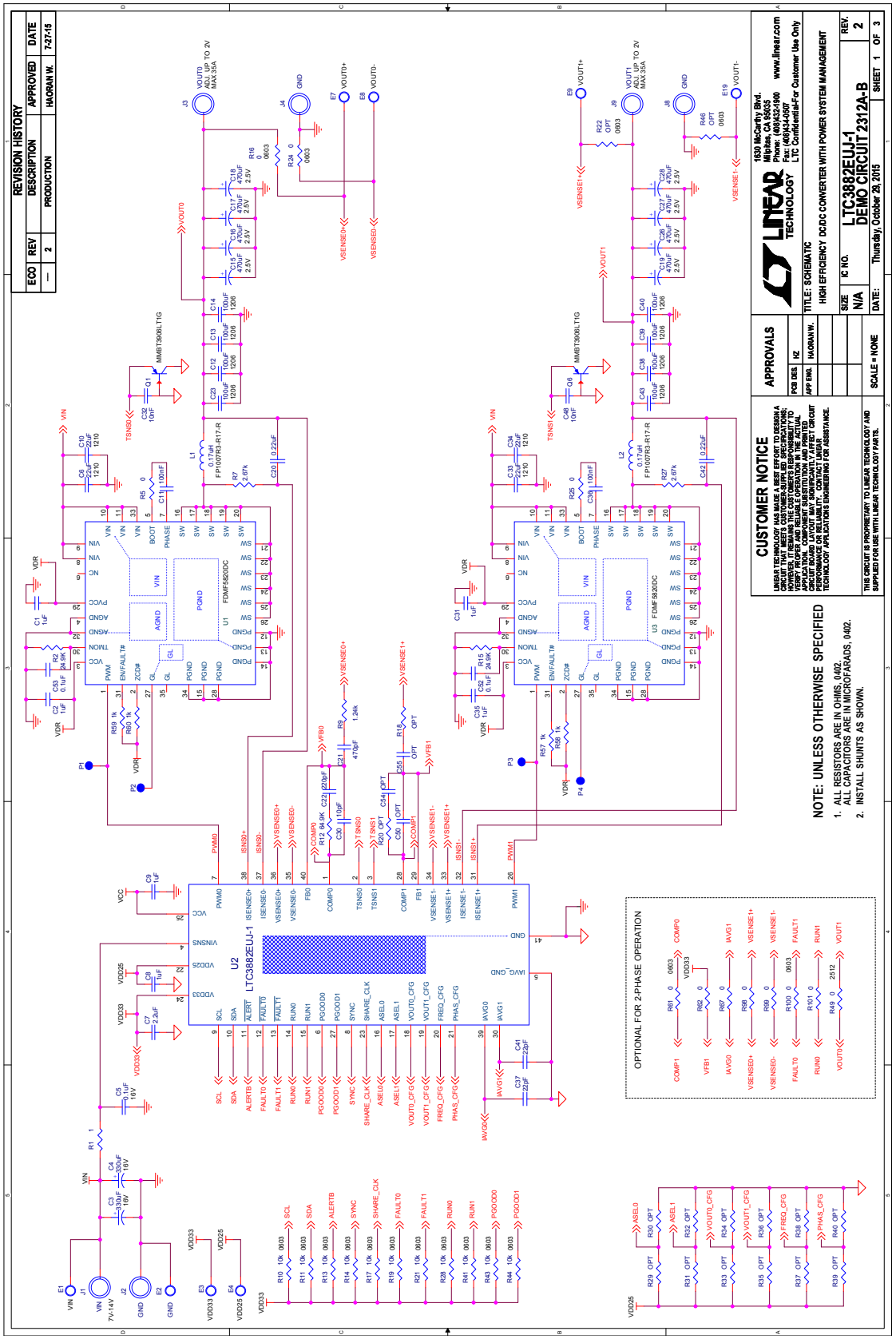
## SCHEMATIC DIAGRAM DC2312A-A



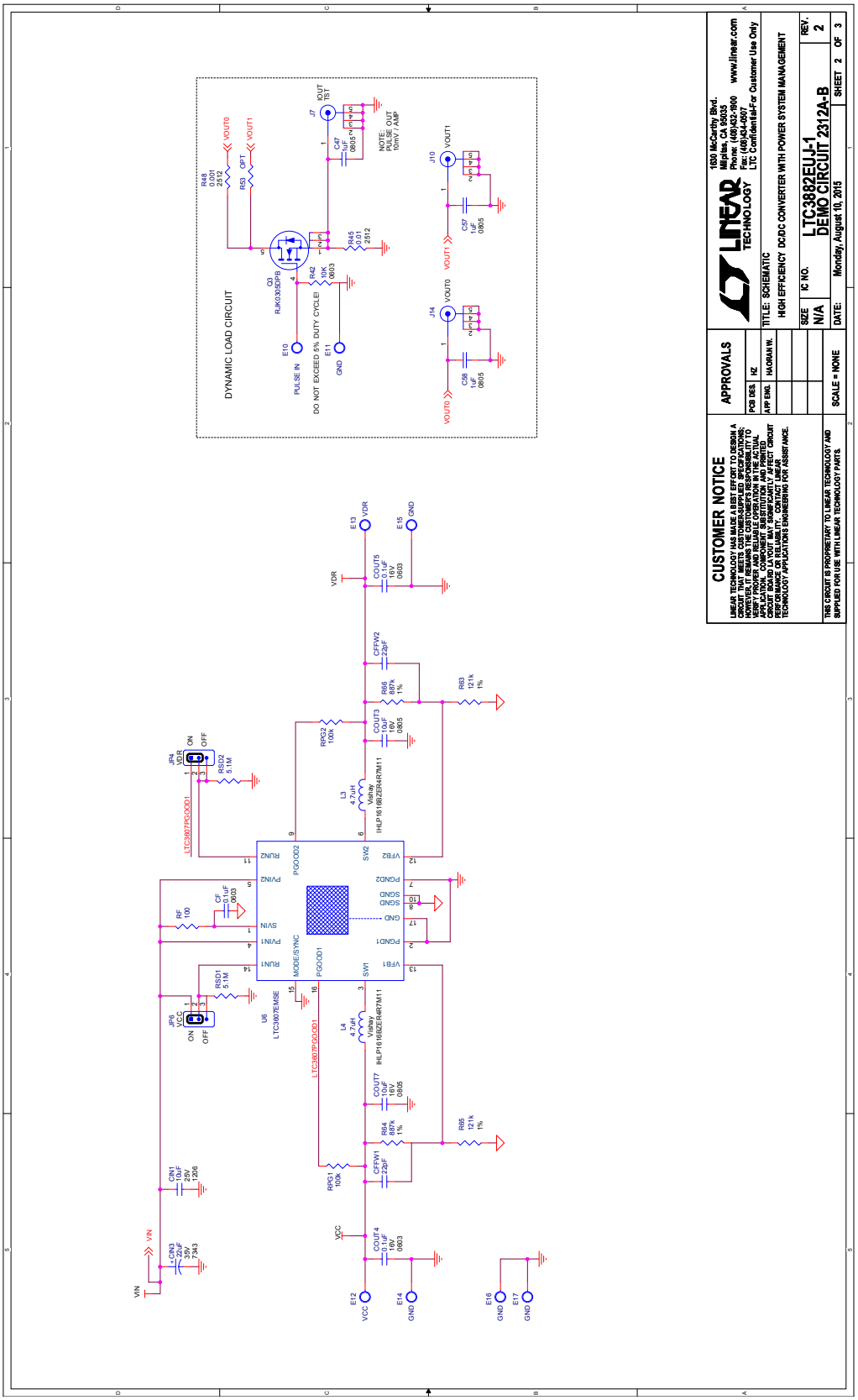
## SCHEMATIC DIAGRAM DC2312A-A



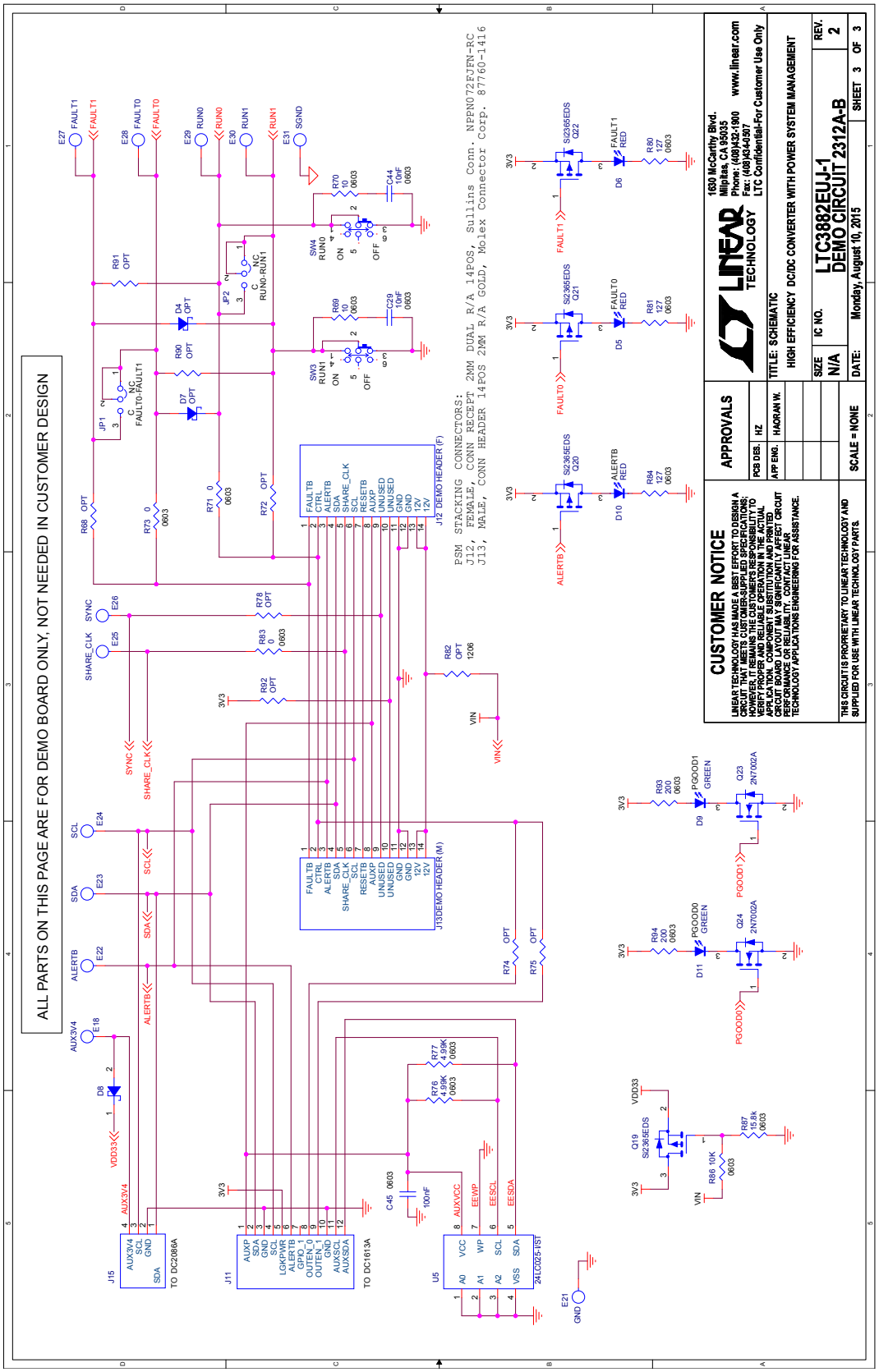
## SCHEMATIC DIAGRAM DC2312A-B



## SCHEMATIC DIAGRAM DC2312A-B



# SCHEMATIC DIAGRAM DC2312A-B



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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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