LTM4676A
Dual Step-Down µModule Regulator with PMBus Digital Power System Management

DESCRIPTION

Demonstration circuit 1811B-B is a dual-output, high efficiency, high density, µModule® regulator with 4.5V to 26.5V input range. Each output can supply 13A maximum load current. The demo board has a LTM®4676A µModule regulator, which is a dual 13A or single 26A step-down regulator with PMBus power system management. Please see LTM4676A data sheet for more detailed information.

The DC1811B-B powers up to default settings and produces power based on configuration resistors 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 ADI's I2C/SMBus/PMBus dongle DC1613A to connect to the board. LTpowerPlay allows the user to reconfigure the part on-the-fly and store the configuration in EEPROM, view telemetry of voltage, current, temperature and fault status.

GUI Download

The software can be downloaded from: LTpowerPlay

For more details and instructions of LTpowerPlay, please refer to LTpowerPlay GUI for LTM4676A Quick Start Guide.

Design files for this circuit board are available.

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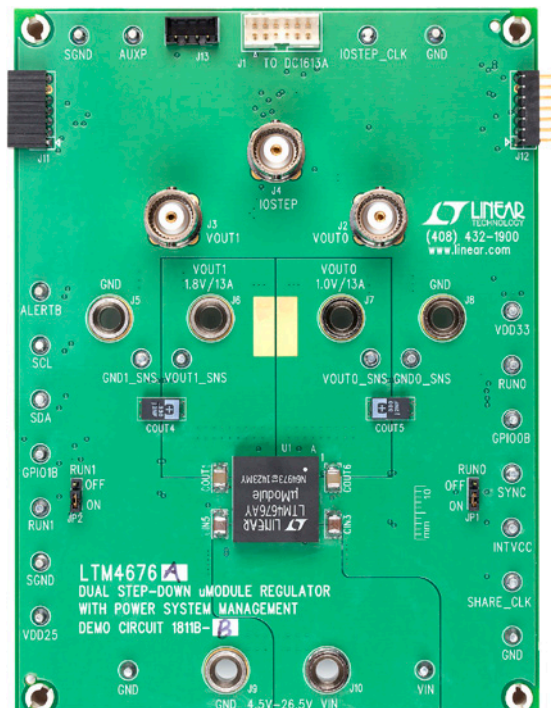
BOARD PHOTO

Figure 1. Dual-Output LTM4676A/DC1811B-B Demo Circuit

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PERFORMANCE SUMMARY $(T_A = 25°C)$

PARAMETER	CONDITION	VALUE
Input Voltage Range		4.5V to 26.5V
Output Voltage, V_{OUT0}	V_{IN} = 4.5V to 26.5V, I_{OUT0} = 0A to 13A	0.5V to 5.5V (Minimum On)*, Default: 1V
Maximum Output Current, I_{OUT0}	V_{IN} = 4.5V to 26.5V, V_{OUT} = 0.5V to 5.5V	13A
Output Voltage, V_{OUT1}	V_{IN} = 4.5V to 26.5V, I_{OUT1} = 0A to 13A	0.5V to 5.5V (Minimum On)*, Default: 1.8V
Maximum Output Current, I_{OUT1}	V_{IN} = 4.5V to 26.5V, V_{OUT} = 0.5V to 5.5V	13A
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 1.8V, I_{OUT} = 13A	86.3%
Default Switching Frequency		500kHz

*For low duty cycle applications, it may approach minimum on the limit. The minimum on-time for LTM4676A is 45ns nominal, guardband to 90ns.

QUICK START PROCEDURE

Table 1. LTM4676/LTM4676A Demo Cards for Up to 130A Point-of-Load Regulation

MAXIMUM OUTPUT CURRENT	NUMBER OF OUTPUT VOLTAGES	NUMBER OF LTM4676/LTM4676A μMODULE REGULATORS ON THE BOARD	DEMO BOARD NUMBER
13A, 13A	2	1× LTM4676	DC1811A/DC1811B-A
13A, 13A	2	1× LTM4676A	DC1811B-B
26A	1	1× LTM4676	DC2087A
50A	1	2× LTM4676	DC1989A-A
75A	1	3× LTM4676	DC1989A-B
100A	1	4× LTM4676	DC1989A-C
100A	1	1× LTM4676 (+ 3× LTM4620A)	DC2106A-A
130A	1	1× LTM4676 (+ 3× LTM4630)	DC2106A-B

Demonstration circuit 1811B-B is easy to set up to evaluate the performance of the LTM4676A. Refer to Figure 2 for the proper measurement equipment setup and follow the procedure below.

1. With power off, connect the input power supply to V_{IN} (4.5V to 26.5V) and GND (input return).

2. Connect the 1.0V output load between V_{OUT0} and GND (Initial load: no load).

3. Connect the 1.8V output load between V_{OUT1} and GND (Initial load: no load).

4. Connect the DVMs to the input and outputs. Set default jumper position: JP1: ON; JP2: ON.

5. Turn on the input power supply and check for the proper output voltages. V_{OUT0} should be 1.0V ±0.5 %, and V_{OUT1} should be 1.8V ±0.5%.

6. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

7. Connect the dongle and control the output voltages from the GUI. See "LTpowerPlay GUI for the LTM4676A Quick Start Guide" for details.

Note: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 3 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (−) terminals of an output capacitor. The probe's ground ring needs to touch the (−) lead and the probe tip needs to touch the (+) lead.

Connecting a PC to DC1811B-B

You can use a PC to reconfigure the power management features of the LTM4676A such as: nominal V_{OUT}, margin set points, OV/UV limits, temperature fault limits, sequencing parameters, the fault log, fault responses, GPIOs and other functionality. The DC1613A dongle may be plugged when V_{IN} is present.
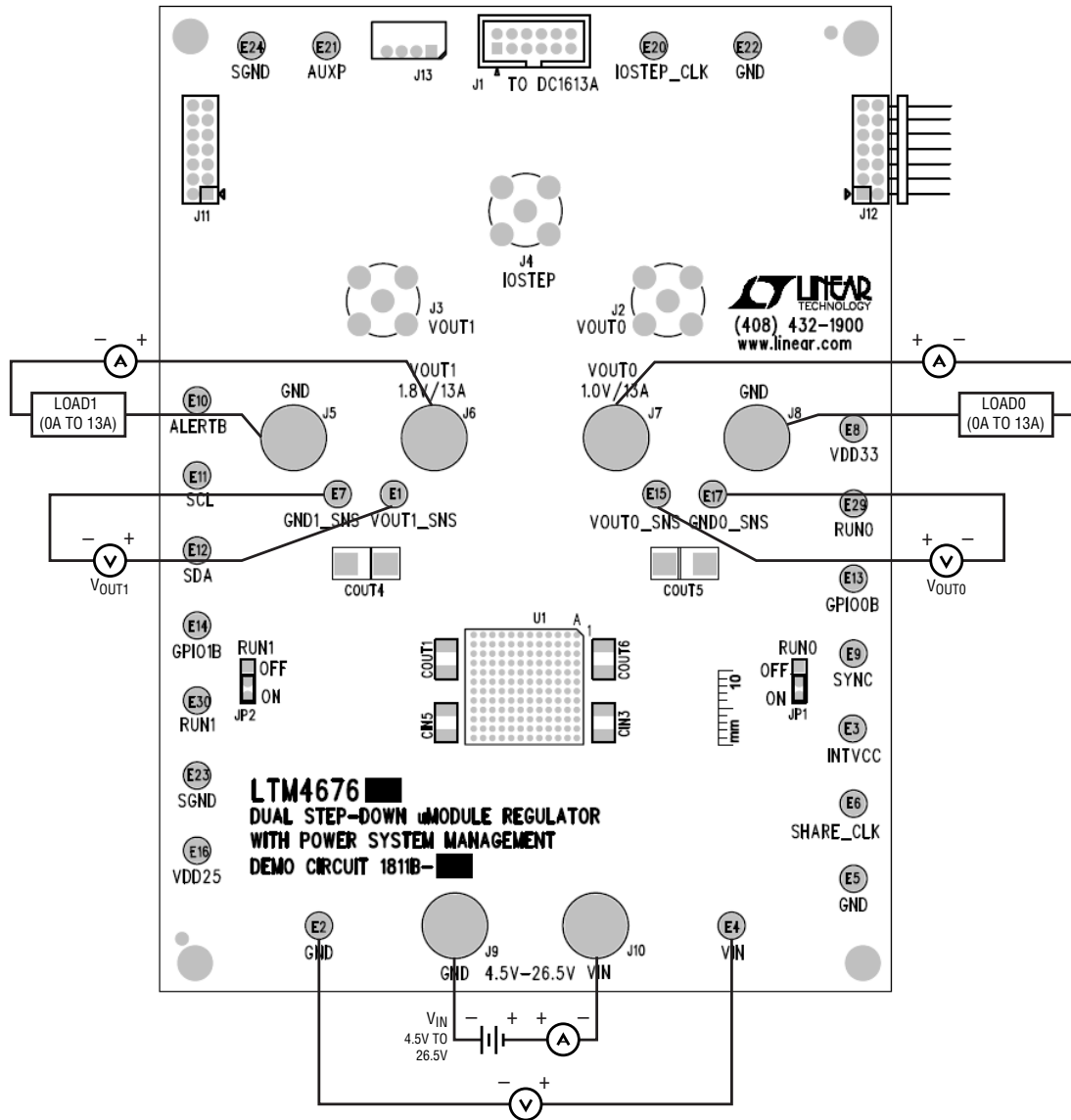
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QUICK START PROCEDURE

Figure 2. Proper Measurement Equipment Setup
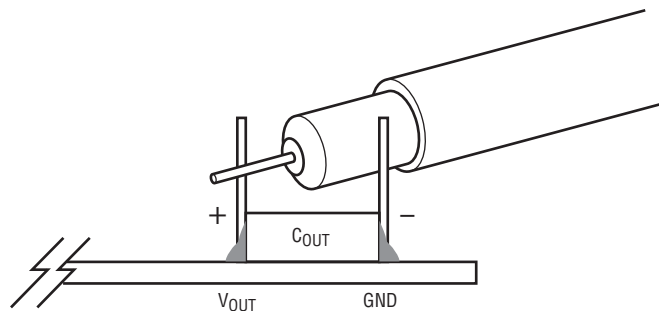

Figure 3. Measuring Output Voltage Ripple
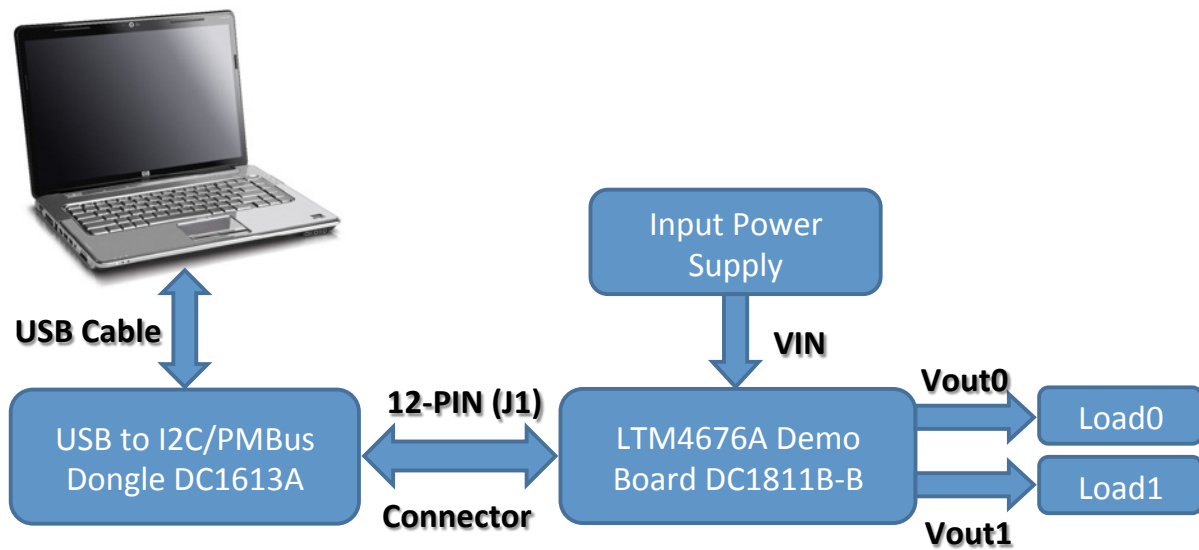
QUICK START PROCEDURE
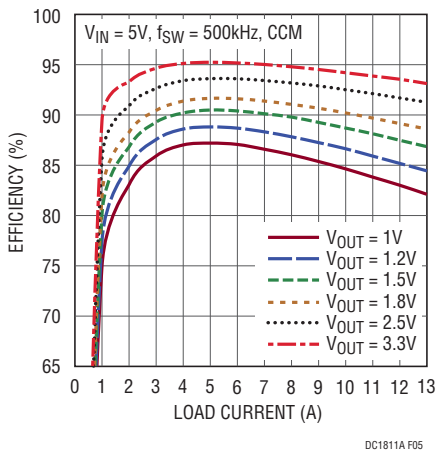

Figure 4. Demo Setup with PC

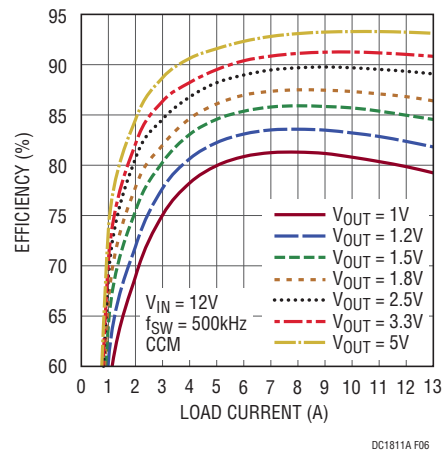Figure 5. Efficiency vs Load Current at V_{IN} = 5V

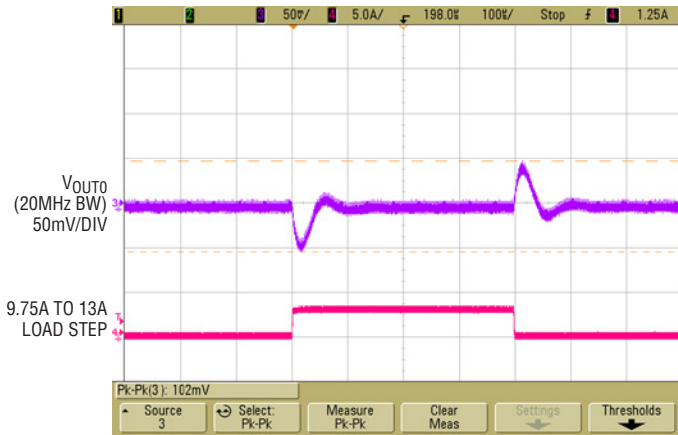Figure 6. Efficiency vs Load Current at V_{IN} = 12V

QUICK START PROCEDURE

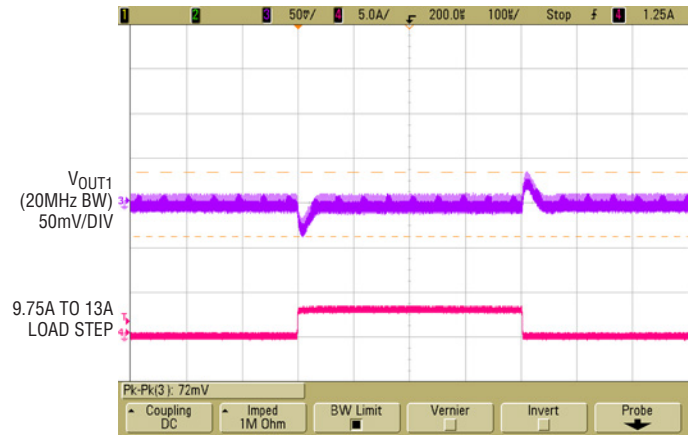Figure 7. Output Voltage V_{OUT0} vs Load Current (V_{OUT0} Range = 0)

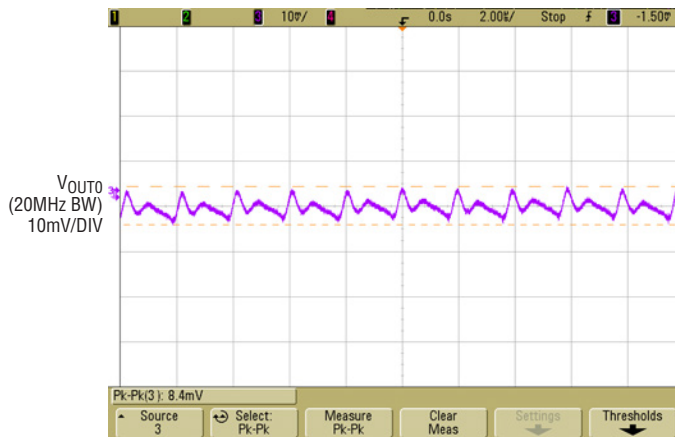Figure 8. Output Voltage V_{OUT1} vs Load Current (V_{OUT1} Range = 1)

Figure 9. Output Voltage Ripple at V_{IN} = 12V, V_{OUT0} = 1V, I_{OUT0} = 13A
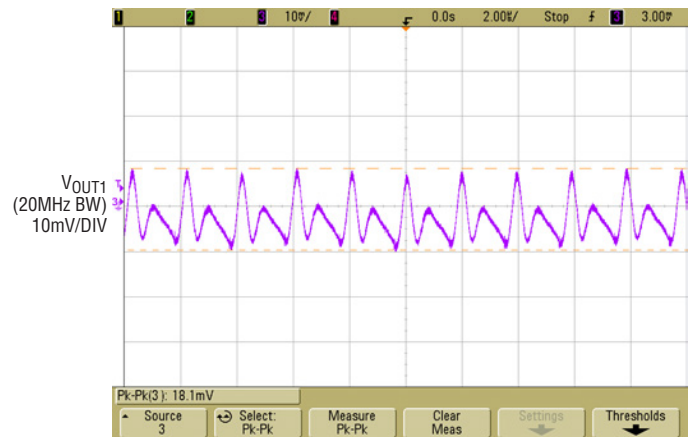

Figure 10. Output Voltage Ripple at V_{IN} = 12V, V_{OUT1} = 1.8V, I_{OUT1} = 13A
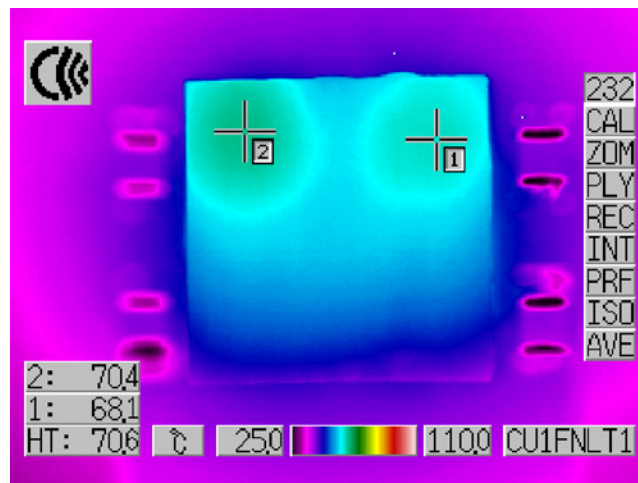

Figure 11. Thermal Performance at V_{IN} = 12V, V_{OUT0} = 1.0V, I_{OUT0} = 13A, V_{OUT1} = 1.8V, I_{OUT1} = 13A, T_A = 24°C, 200LFM Airflow

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LTpowerPlay SOFTWARE GUI

LTpowerPlay is a powerful Windows-based development environment that supports Analog Devices power system management ICs, including the LTM4676A, LTC3880, LTC3883, LTC2974 and LTC2978. 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 can also be used in an offline mode (with no hardware present) in order to build a multichip 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 LTM4676A, the LTC3880 and the LTC3883's demo system, or a customer board. The software also provides an automatic update feature to keep the soft-ware current with the latest set of device drivers and documentation. The LTpowerPlay software can be downloaded from:

LTpowerPlay

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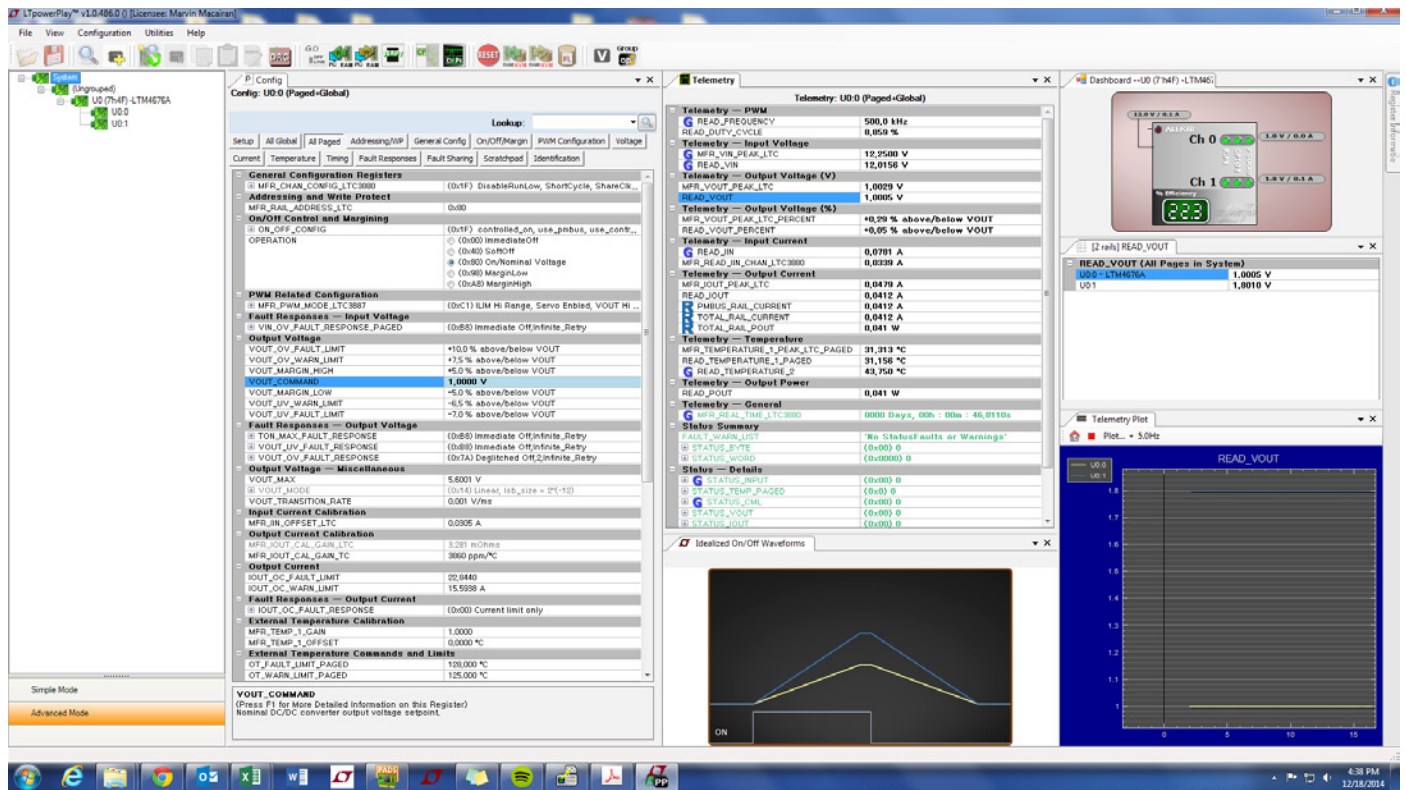

Figure 12. LTpowerPlay Main Interface

LTpowerPlay QUICK START GUIDE

The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTM4676A.
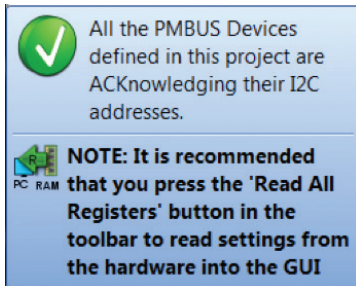
1. Download and install the LTPowerPlay GUI:

   LTpowerPlay

2. Launch the LTpowerPlay GUI.

   a. The GUI should automatically identify the DC1811B-B. The system tree on the left hand side should look like this:
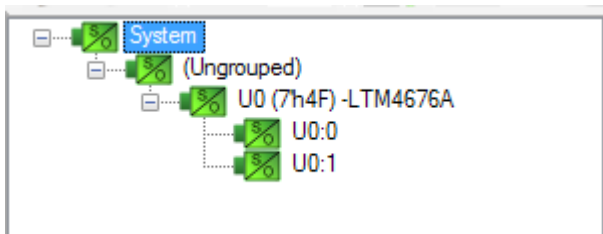

   b. A green message box shows for a few seconds in the lower left hand corner, confirming that LTM4676A is communicating:

   c. In the Toolbar, click the "R" (RAM to PC) icon to read the RAM from the LTM4676A. This reads the configuration from the RAM of LTM4676A and loads it into the GUI.
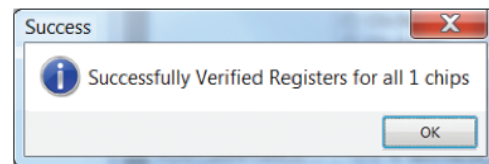

   d. If you want to change the output voltage to a different value, like 1.5V. In the Config tab, type in 1.5 in the VOUT_COMMAND box, like this:
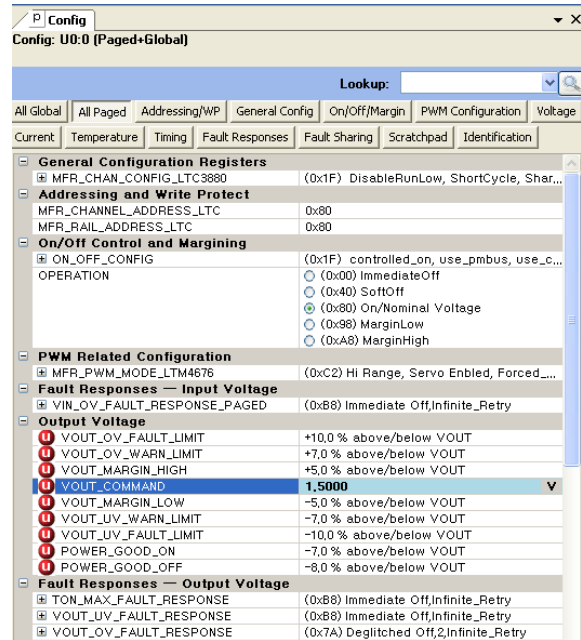
   Then, click the "W" (PC to RAM) icon to write these register values to the LTM4676A. After finishing this step, you will see the output voltage will change to 1.5V.

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

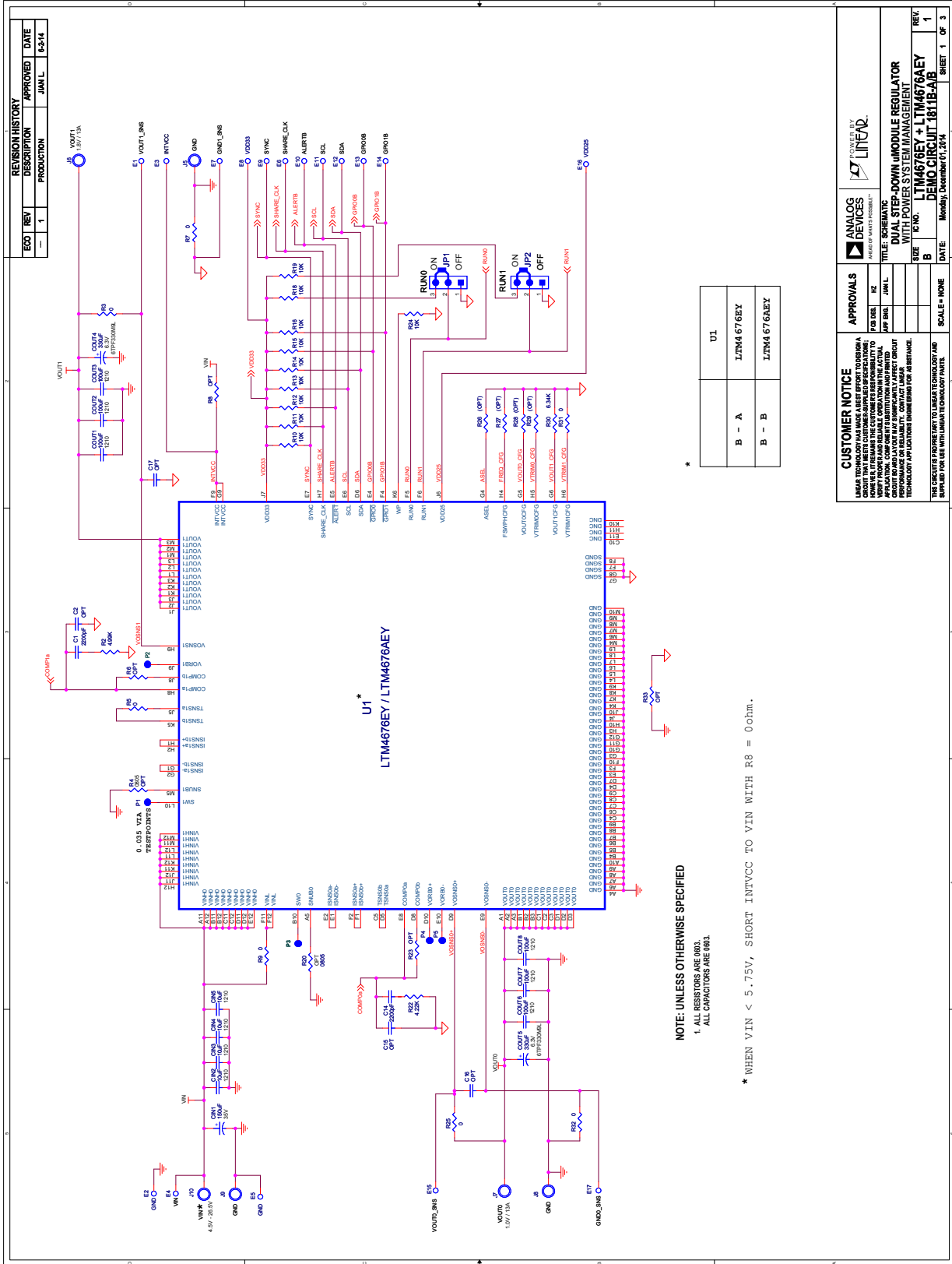   e. You can save the changes into the NVM. In the tool bar, click "RAM to NVM" button, as following

   f. Save the demo board configuration to a (*.proj) file. Click the Save icon and save the file. Name it whatever you want.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP., 150µF, 35V, ALUMINUM ELECTR.,	SUN ELECT., 35CE150AX
2	4	CIN2, CIN3, CIN4, CIN5	CAP., X5R, 10µF, 35V, 10%,1210	MURATA, GRM32ER6YA106KA12
3	6	COUT1-COUT3, COUT6-COUT8	CAP., X5R, 100µF, 6.3V, 20%, 1210	AVX, 12106D107MAT2A
4	2	COUT4, COUT5	CAP., 330µF, 6.3V, POSCAP, D3L	PANASONIC, 6TPF330M9L
5	2	C1, C14	CAP., X7R, 2200pF, 25V, 10%, 0603	AVX, 06033C222KAT2A
6	1	C26	CAP., X5R, 100nF, 16V, 10%,0603	AVX, 0603YD104KAT2A
7	2	C27, C28	CAP., X7R, 10nF, 16V, 10%,0603	AVX, 0603YC103KAT2A
8	1	C23	CAP., X7R, 1µF, 25V,10%, 0805	AVX, 08053C105KAT2A
9	3	C21, C22, C24	CAP., X5R, 1µF, 25V,10%, 0603	AVX, 06033D105KAT2A
10	2	JP1, JP2	HEADER 3-PIN 0.079 SINGLE ROW	SULLIN, NRPN031PAEN-RC
11	3	J2-J4	CONN, BNC, 5 PINS	CONNEX, 112404
12	1	J1	CONN HEADER 12POS 2mm STR DL PCB	FCI, 98414-G06-12ULF
13	6	J5-J10	BANANA JACK	KEYSTONE, 575-4
14	1	Q1	N-CHANNEL 40-V MOSFET	VISHAY, SUD50N04-8M8P-4GE3
15	1	D8	DIODE, ULTRA LOW SCHOTTKY RECTIFIER	NXP SEMI., PMEG2005AEL
16	1	Q19	P-CHANNEL 30-V MOSFET	DIODES INC., DMP3130L-7
17	1	J11	CONN RECEPT 2mm DUAL R/A 14POS (F)	SULLINS, NPPN072FJFN-RC
18	1	J12	HEADER 14POS 2mm R/A GOLD (M)	MOLEX, 87760-1416
19	1	J13	HEADER, 4 PINS, SHROUDED	HIROSE, DF3A-4P-2DSA
20	10	R3, R5, R7, R9, R25, R31, R32, R63, R65, R66	RES., CHIP, 0Ω, 1%, 0603	NIC, NRC06ZOTRF
21	2	R69, R70	RES., CHIP, 10k, 1%, 0603	NIC, NRC06F10R0TRF
22	12	R10-R16, R18, R19, R24, R52, R77	RES., CHIP, 10k, 1%, 0603	NIC, NRC06F1002TRF
23	1	R78	RES., CHIP, 15.8k, 1%, 0603	NIC, NRC06F1582TRF
24	1	R30	RES., CHIP, 6.34k, 1%, 0603	VISHAY, CRCW06036K34FKEA
25	3	R2, R72, R73	RES., CHIP, 4.99k, 1%, 0603	NIC, NRC06F4991TRF
26	1	R22	RES., CHIP, 4.22k, 1%, 0603	VISHAY, CRCW06034K22FKEA
27	1	R48	RES., CHIP, 0Ω, 0.5W, 2010	NIC, NRC50ZOTRF
28	1	R53	RES., CHIP, 0.01Ω, 1/2W, 1%, 2010	VISHAY, WSL2010R0100FEA
29	1	U3	IC, 24LC025-I/ST, SOIC	MICROCHIP, 24LC025-I/ST
30	1	U1	IC, LTM4676AEY#PBF	ANALOG DEVICES, LTM4676AEY#PBF
Additional Demo Board Circuit Components				
1	0	C2, C15-C17(OPT)	CAP., 0603	
2	0	D1, D2 (OPT)	DIODE, SOD-323	
3	0	R4, R6, R8, R20, R23, R26-R29, R33, R35, R37, R38, R41, R49, R61, R62, R64, R67, R68, R74, R75, R82, R83, R88, R89 (OPT)	RES., OPTIONAL	
4	0	R50, R51(OPT)	RES., CHIP, 30, 1%, 2512	
Hardware-For Demo Board Only				
1	24	E1-E17, E20-E24, E28, E29	TESTPOINT, TURRET, 0.062"	MILL-MAX, 2308-2-00-80-00-00-07-0
2	2	XJP1, XJP2	SHUNT	SAMTEC, 2SN-BK-G
3	4	(STAND-OFF)	STAND-OFF, NYLON 0.50" TALL (SNAP ON)	KEYSTONE, 8833
4	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1811B-B

SCHEMATIC DIAGRAM

SCHEMATIC DIAGRAM

ALL PARTS ON THIS PAGE ARE FOR DEMO ONLY, NOT NEEDED IN CUSTOMER DESIGN

DYNAMIC LOAD CIRCUIT

DO NOT EXCEED 5% DUTY CYCLE!

BLEEDER LOADS

OPTIONAL JUMPER FOR DUAL PHASE
SINGLE OUTPUT CONFIGURATION

CUSTOMER NOTICE

LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

APPROVALS

| PCB DES. | HZ |
| APP ENG. | JIAN L. |

TITLE: SCHEMATIC
DUAL STEP-DOWN uMODULE REGULATOR
WITH POWER SYSTEM MANAGEMENT

| SIZE | IC NO. | LTM4676EY / LTM4676AEY | REV. |
| N/A | | DEMO CIRCUIT 1811B-A/B | 1 |

DATE: Monday, December 01, 2014

SCALE = NONE

SHEET 2 OF 3

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SCHEMATIC DIAGRAM

ALL PARTS ON THIS PAGE ARE FOR DEMO BOARD ONLY, NOT NEEDED IN CUSTOMER DESIGN

PSM STACKING CONNECTORS:
J1, MALE, CONN HEADER 14POS 2MM R/A GOLD, Molex Connector Corp. 87760-1416
J2, FEMALE, CONN RECPT 2MM DUAL R/A 14POS, Sullins Conn. NPPN072FJFN-RC

OPTIONAL CIRCUIT FOR PROGRAMMING WITHOUT VIN

CUSTOMER NOTICE

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THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

APPROVALS	
PCB DES.	HZ
APP ENG.	JIAN L.

ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

POWER BY LINEAR™

TITLE: SCHEMATIC
DUAL STEP-DOWN µMODULE REGULATOR
WITH POWER SYSTEM MANAGEMENT

IC NO.	LTM4676EY / LTM4676AEY	REV. 1
SIZE N/A	DEMO CIRCUIT 1811B-A/B	
DATE:	Monday, December 01, 2014	SHEET 3 OF 3

SCALE = NONE
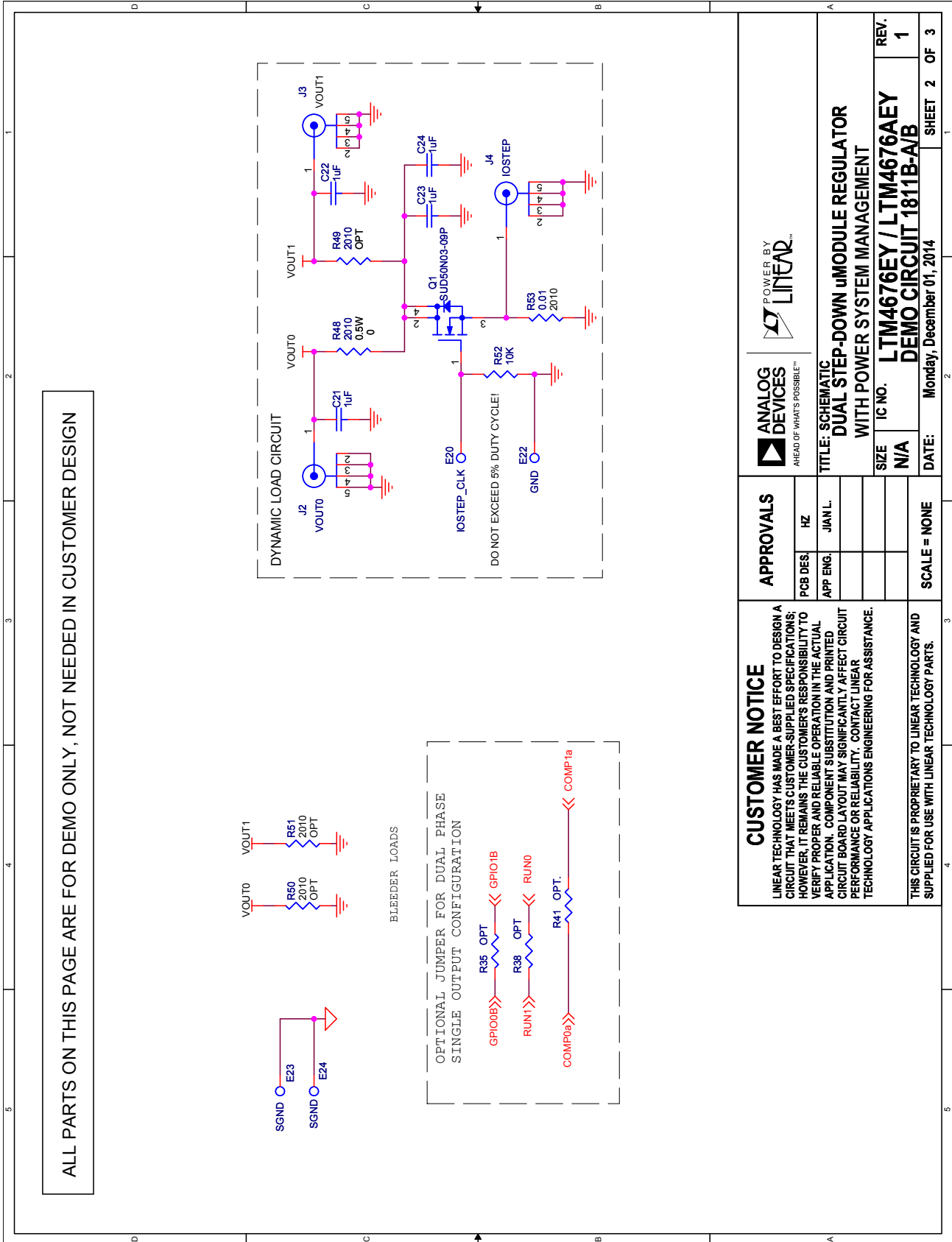
ESD Caution

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.

Rev. A

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