LTM4676EY
Dual Step-Down µModule Regulator with PMBus Power System Management

DESCRIPTION

Demonstration circuit 2269A-A is a dual-output, high efficiency, high density, µModule® supply on a small 1.5"×1.2" PCB board with 4.5V to 26.5V input range. Each output can supply 13A maximum load current. The demo board has a LTM®4676 µModule regulator, which is a dual 13A or single 26A step-down regulator with PMBus power system management. The DC2269A can be easily inserted to an edge connector for testing and debugging. It has an optional input filter inductor (L1) to further reduce input ripple EMI noise.

DC2269A-A powers up to default settings and produce 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 LTC's I²C/SMBus/PMBus dongle DC2086A together with 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:

http://www.linear.com/ltpowerplay

For more details and instructions of LTpowerPlay, please refer to LTpowerPlay GUI for LTM4676 Quick Start Guide.

Design files for this circuit board are available at http://www.linear.com/demo/DC2269A-A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	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 4V, Default: 1V
Maximum Output Current, I_{OUT0}	V_{IN} = 4.5V to 26.5V, V_{OUT} = 0.5V to 4V	13A
Output Voltage, V_{OUT1}	V_{IN} = 4.5V to 26.5V, I_{OUT1} = 0A to 13A	0.5V to 5.4V, Default: 1.8V
Maximum Output Current, I_{OUT1}	V_{IN} = 4.5V to 26.5V, V_{OUT} = 0.5V to 5.4V	13A
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 1.8V, I_{OUT} = 13A	86.3%
Default Switching Frequency		500kHz

Figure 1. Dual-Output LTM4676/DC2269A-A Demo Circuit

QUICK START PROCEDURE

Table 1. LTM4676 Demo Cards for Up to 100A Point-of-Load Regulation

MAXIMUM OUTPUT CURRENT	NUMBER OF OUTPUT VOLTAGES	NUMBER OF LTM4676 µMODULE REGULATORS ON THE BOARD	DEMO BOARD NUMBER
13A, 13A	2	1	DC1811A
13A, 13A	2	1	DC2269A-A
26A	1	1	DC2087A
50A	1	2	DC1989A-A
75A	1	3	DC1989A-B
100A	1	4	DC1989A-C
100A	1	1 + (3× LTM4620A)	DC2106A-A
130A	1	1 + (3× LTM4630)	DC2106A-B

DC2269A-A is easy to set up to evaluate the performance of the LTM4676EY. It can be easily inserted to an edge connector (SAMTEC MEC2-20-01-L-DV--TR) for testing and debugging. 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-26.5V) and GND (input return).
2. Connect the 1.0V output load between V_{OUT} and GND (Initial load: no load).
3. Connect the 1.8V output load between V_{OUT} and GND (Initial load: no load).
4. Connect the DVMs to the input and outputs.
5. Turn on the input power supply and check for the proper output voltages. V_{OUT0} should be 1.0V ±1%, and V_{OUT1} should be 1.8 ±1%.
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 volt-ages from the GUI. See “LTpowerPlay GUI for the LTM4676 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 DC2269A-A

You can use a PC to reconfigure the power management features of the LTM4676 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 DC2086A dongle may be plugged when V_{IN} is present.

QUICK START PROCEDURE

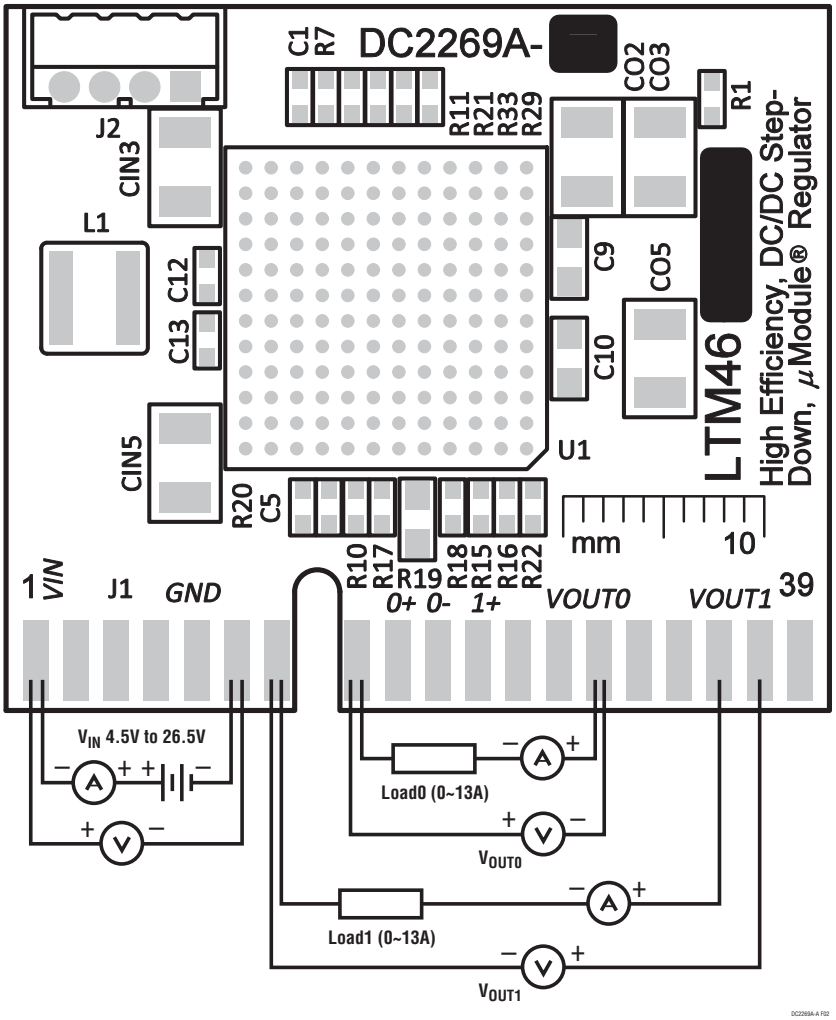


Figure 2. Proper Measurement Equipment Setup

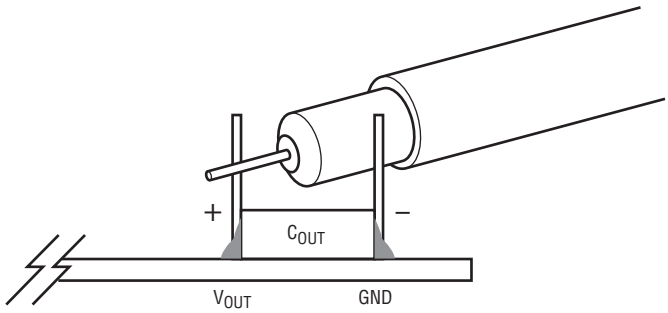


Figure 3. Measuring Output Voltage Ripple

QUICK START PROCEDURE

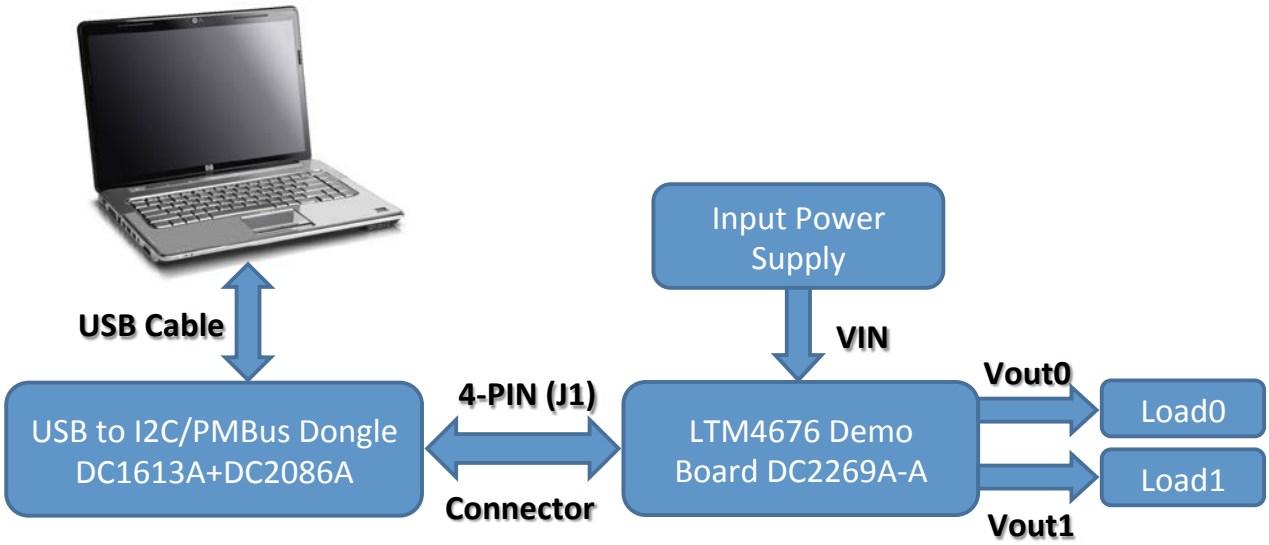


Figure 4. Demo Setup with PC

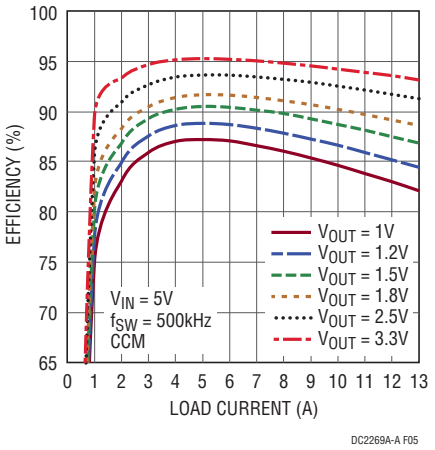


Figure 5. Efficiency vs Load Current at V_{IN} = 5V

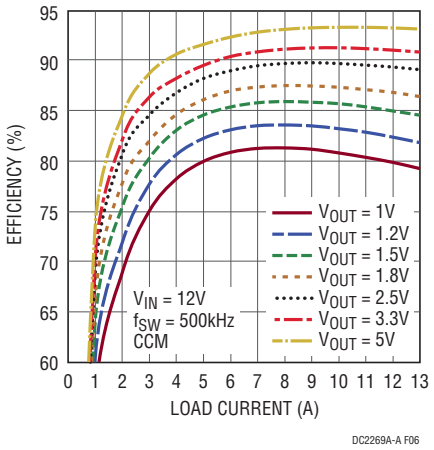


Figure 6. Efficiency vs Load Current at V_{IN} = 12V

QUICK START PROCEDURE

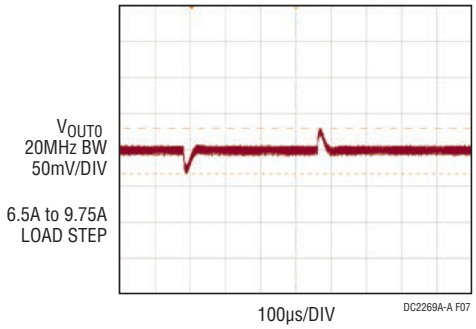


Figure 7. Output Voltage V_{OUT0} vs Load Current (V_{OUT0} RANGE = 1)

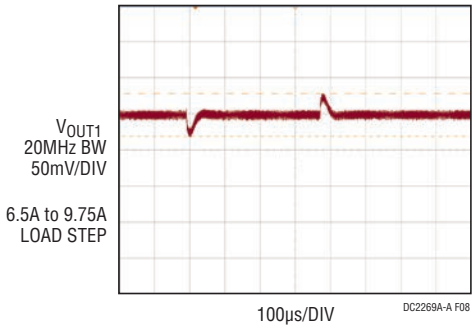


Figure 8. Output Voltage V_{OUT1} vs Load Current (V_{OUT1} RANGE = 1)

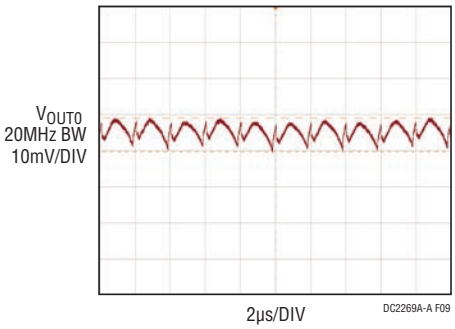


Figure 9. Output Voltage Ripple at V_{IN} = 12V, V_{OUT0} = 1V, I_{OUT0} = 13A

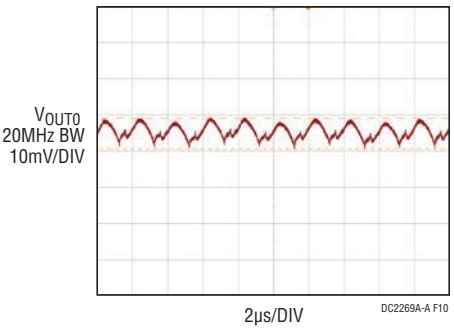


Figure 10. Output Voltage Ripple at V_{IN} = 12V, V_{OUT0} = 1.8V, I_{OUT0} = 13A

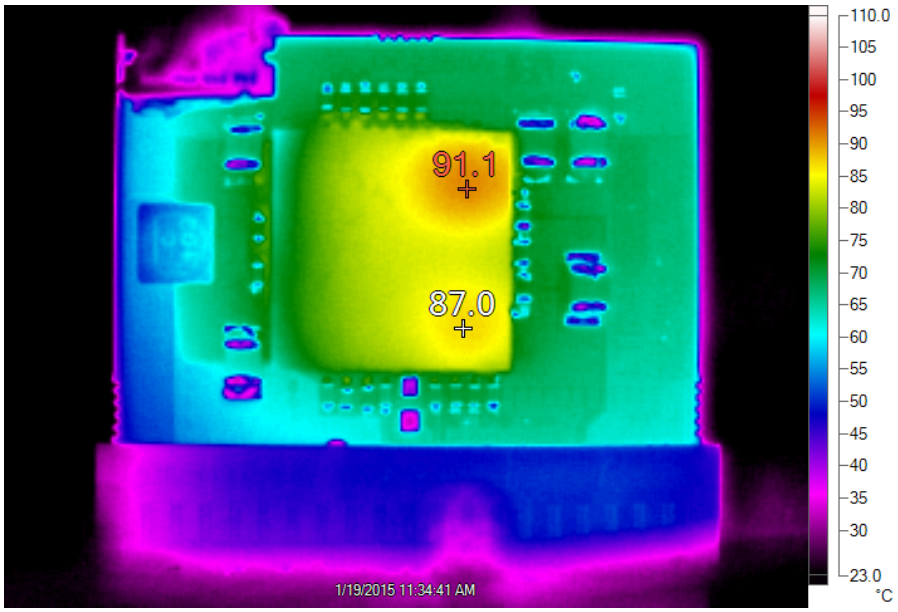


Figure 11. Thermal Performance at V_{IN} = 12V, V_{OUT0} = 1V/11A, V_{OUT1} = 1.8V/11A, f_{SW} = 500kHz, T_A = 23°C, 200LFM Airflow

LTpowerPlay Software GUI

LTpowerPlay is a powerful Windows based development environment that supports Linear Technology power system management ICs, including the LTM4675, LTM4676, LTC3880, LTC3882, LTC3883, LTC2974 and 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 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 and DC2086A USB-to-SMBus controller to communicate with one of many potential targets, including the LTM4676, the LTC3880, LTC3882 and the LTC3883's 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://linear.com/ltpowerplay

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

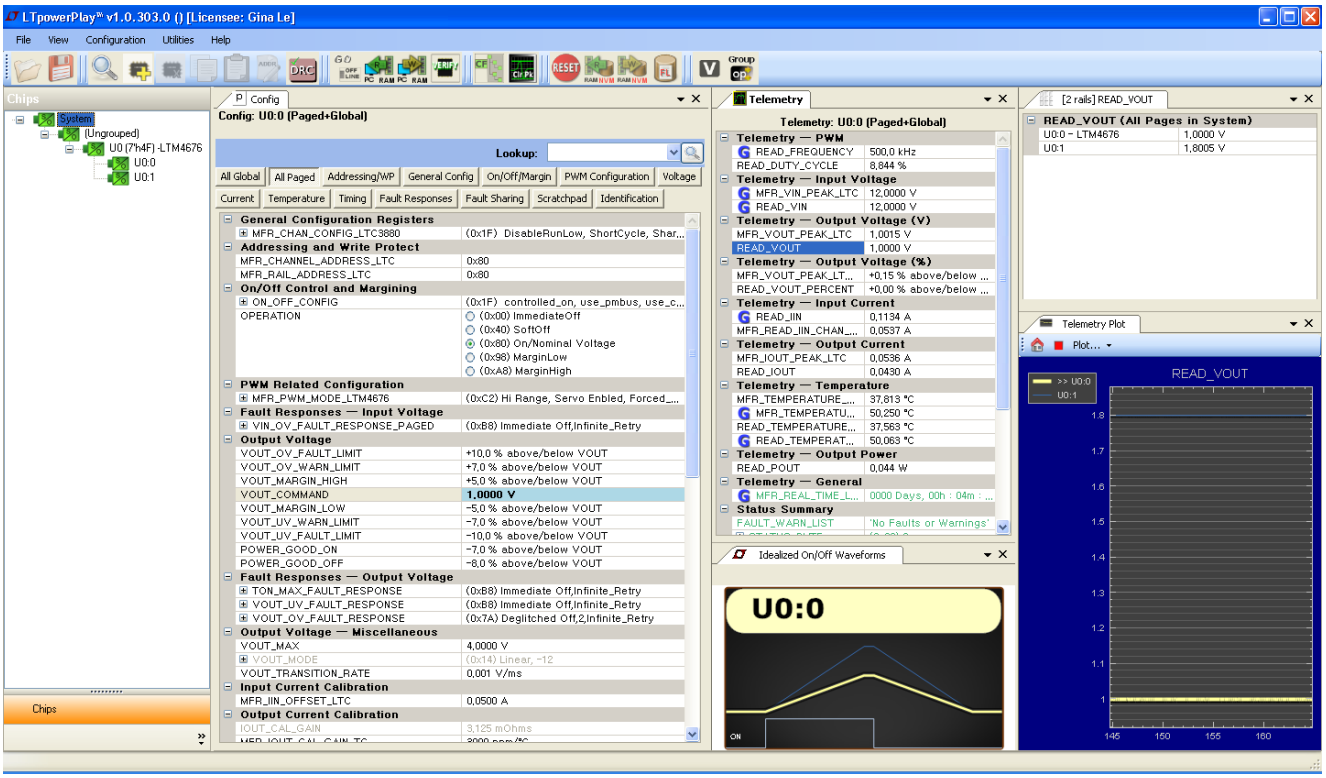


Figure 12. LTpowerPlay Main Interface

LTpowerPlay Quick Start Procedure

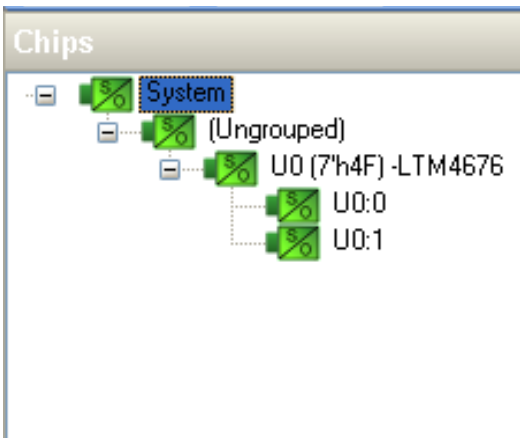
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTM4676.

1. Download and install the LTPowerPlay GUI:

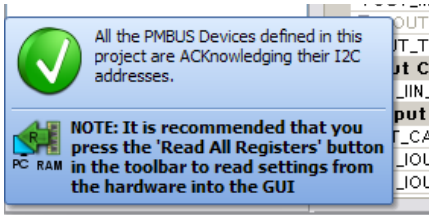
   http://linear.com/ltpowerplay

2. Launch the LTpowerPlay GUI.

   a. The GUI should automatically identify the DC2269A-A. The system tree on the left hand side should look like this:

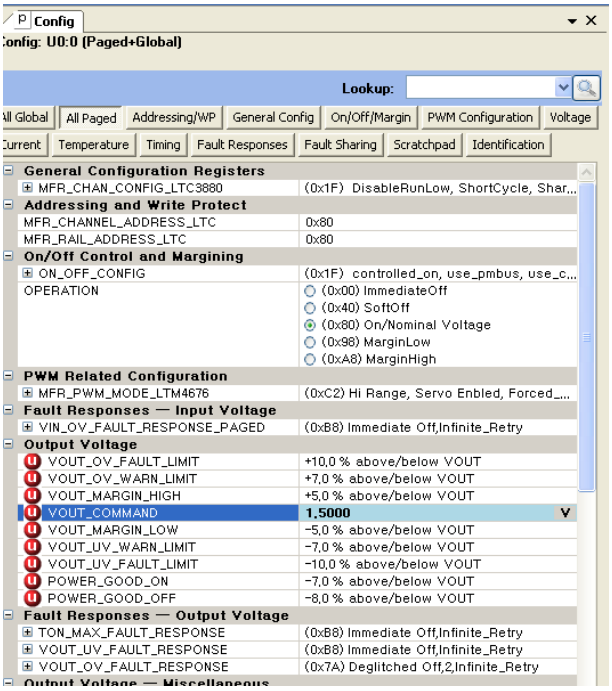


   b. A green message box shows for a few seconds in the lower left hand corner, confirming that LTM4676 is communicating:



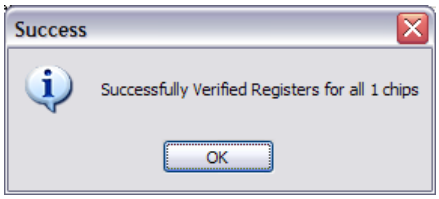
   c. In the Toolbar, click the "R" (RAM to PC) icon to read the RAM from the TM4676. This reads the configuration from the RAM of LTM4676 and loads it into the GUI.

   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 LTM4676. 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:



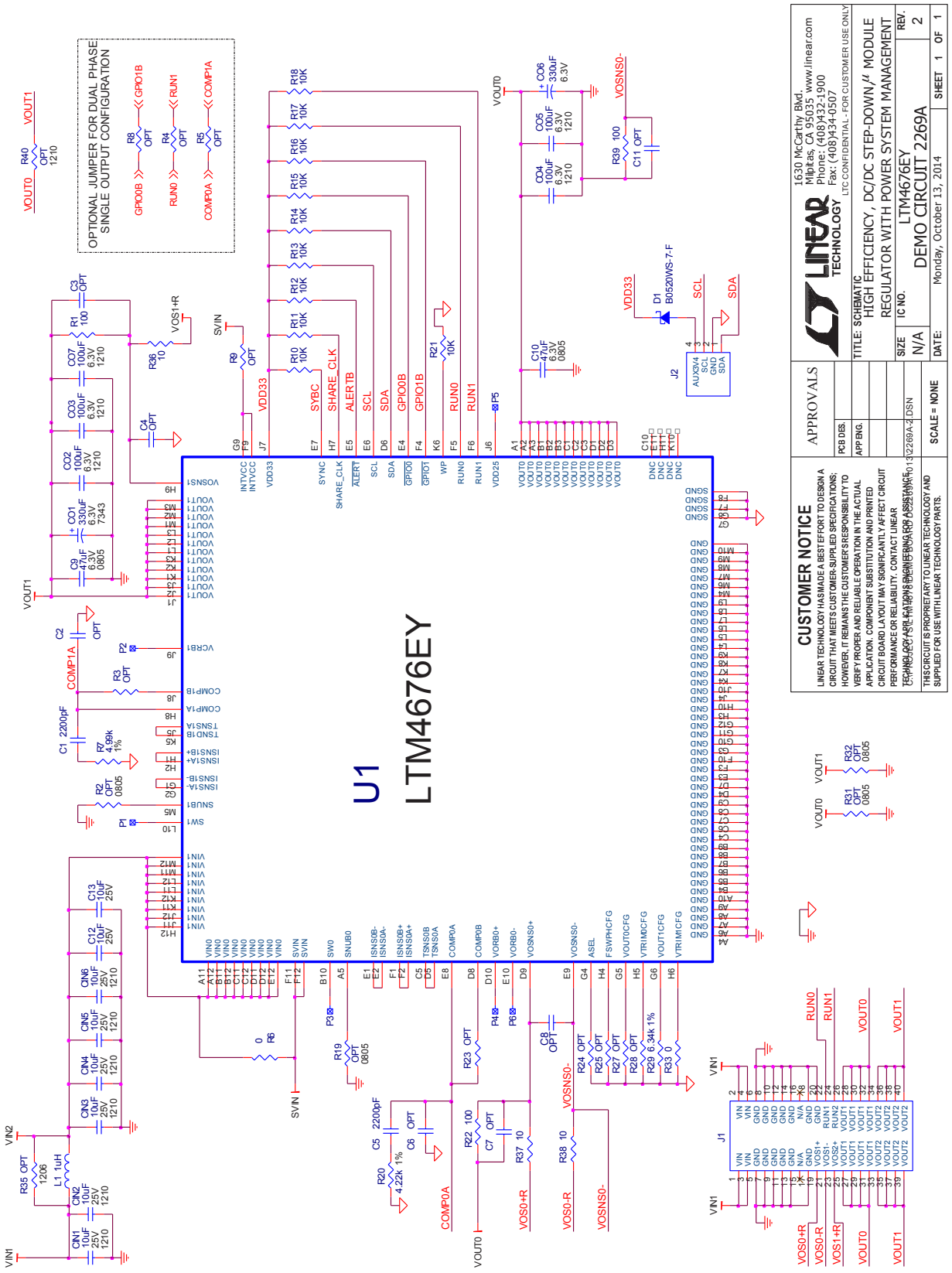
   e. You can save the changes into the NVM. In the tool bar, click "RAM to NVM" button, as following:

   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	6	CIN1, CIN2, CIN3, CIN4, CIN5, CIN6	CAP, 1210 10µF 10% 25V X5R	MURATA GRM32DR61E106KA12L
2	2	CO1, CO6	CAP, 7343 330µF 20% 6.3V POSCAP	PANASONIC 6TPF330M9L
3	5	CO2, CO3, CO4, CO5, CO7	CAP, 1210 100µF 10% 6.3V X5R	AVX 12106D107KAT2A
4	2	C1, C5	CAP, 0603 2200pF 10% 50V X7R	AVX 06035C222KAT2A
5	2	C9, C10	CAP, 0805 47µF 20% 6.3V X5R	MURATA GRM21BR60J476ME15L
6	2	C12, C13	CAP, 0603 10µF 20% 25V X5R	MURATA GRM188R61E106MA73J
7	1	D1	DIODE, SCHOTTKY BARRIER RECTIFIER	DIODES INC. B0530WS-7-F
8	1	J2	HEADER, 4PIN 2mm STR DL	HIROSE DF3A-4P-2DSA
9	1	L1	IND, 1.0µH	COILCRAFT XAL5030-102MEC
10	3	R1, R22, R39	RES, 0603 100Ω 5% 0.1W	VISHAY CRCW0603100RJNEA
11	2	R6, R33	RES, 0603 0Ω	VISHAY CRCW06030000Z0EA
12	1	R7	RES, 0603 4.99kΩ 1% 0.1W	VISHAY CRCW06034K99FKEA
13	10	R10, R11, R12, R13, R14, R15, R16, R17, R18, R21	RES, 0603 10kΩ 5% 0.1W	VISHAY CRCW060310K0JNEA
14	1	R20	RES, 0603 4.22kΩ 1% 1/10W	VISHAY CRCW06034K22FKEA
15	1	R29	RES, 0603 6.34kΩ 1% 0.1W	VISHAY CRCW06036K34FKEA
16	3	R36, R37, R38	RES, 0603 10Ω 5% 0.1W	VISHAY CRCW060310R0JNEA
17	1	U1	IC, VOLTAGE REGULATOR LGA	LINEAR TECH. LTM4676EY#PBF
Additional Demo Board Circuit Components				
1	0	C2, C3, C4, C6, C7, C8, C11	CAP, 0603 OPTION	OPTION
2	0	R2, R19, R31, R32	RES, 0805 OPTION	OPTION
3	0	R3, R4, R5, R8, R9, R23, R24, R25, R27, R28	RES, 0603 OPTION	OPTION
4	0	R35	RES, 1206 OPTION	OPTION
	0	R40	RES, 1210 OPTION	OPTION
Hardware: For Demo Board Only				
1	1	J1	CONN., CARD EDGE	SAMTEC MEC2-20-01-L-DV--TR

SCHEMATIC DIAGRAM



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If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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