LTM4677EY
Dual 18A or Single 36A µModule Regulator With Digital Power System Management

DESCRIPTION

Demonstration circuit 2066A is a dual-output, high efficiency, high density, µModule regulator with 4.5V to 16V input range. Each output can supply 18A maximum load current. The demo board has a LTM®4677 µModule regulator, which is a dual 18A or single 36A step-down regulator with digital power system management. Please see the LTM4677 data sheet for more detailed information.

DC2066A 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 LTC'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:
http://www.linear.com/ltpowerplay

For more details and instructions of LTpowerPlay, please refer to LTpowerPlay GUI for LTM4677 Quick Start Guide.

Design files for this circuit board are available at http://www.linear.com/demo/DC2066A

BOARD PHOTO

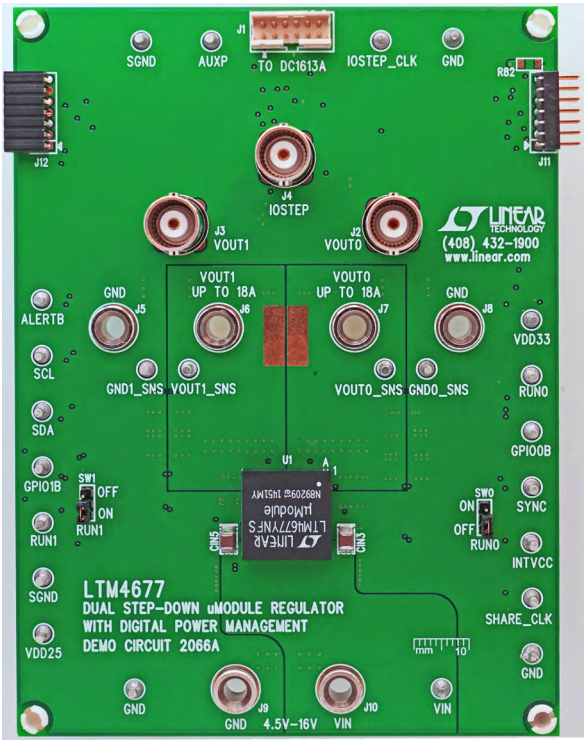


Figure 1. Dual-Output LTM4677/DC2066A Demo Circuit

PERFORMANCE SUMMARY

Table 1. Performance Summary (T_A = 25°C)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		4.5		16	V
Output Voltage, V_{OUT0}	V_{IN} = 4.5V to 16V, I_{OUT0} = 0A to 18A	0.5		1.8	V
Maximum Output Current, I_{OUT0}	V_{IN} = 4.5V to 16V, V_{OUT0} = 0.5V to 1.8V			18	A
Output Voltage, V_{OUT1}	V_{IN} = 4.5V to 16V, I_{OUT1} = 0A to 18A	0.5		1.8	V
Maximum Output Current, I_{OUT1}	V_{IN} = 4.5V to 16V, V_{OUT1} = 0.5V to 1.8V			18	A
Typical Efficiency	V_{IN} = 12V, V_{OUT1} = 1.8V, I_{OUT1} = 18A		87.9 (See Figures 5 and 6)		%
Default Switching Frequency			500		kHz

QUICK START PROCEDURE

Table 2. LTM4677 Demo Boards for Up To 140A Point-of-Load Regulation

MAXIMUM OUTPUT CURRENT	NUMBER OF OUTPUTS	NUMBER OF LTM4676 µMODULE REGULATORS ON THE BOARD	DEMO BOARD NUMBER
Dual 18A	2	1	DC2066A
70A	1	2	DC2143A-A
105A	1	3	DC2143A-B
140A	1	4	DC2143A-C

Demonstration circuit 2066A is easy to set up to evaluate the performance of the LTM4677EY. 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 16V) 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: SW1: ON; SW2: ON.
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 1.8V ±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 voltages from the GUI. See "*LTpowerPlay GUI for the LTM4677 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.

QUICK START PROCEDURE

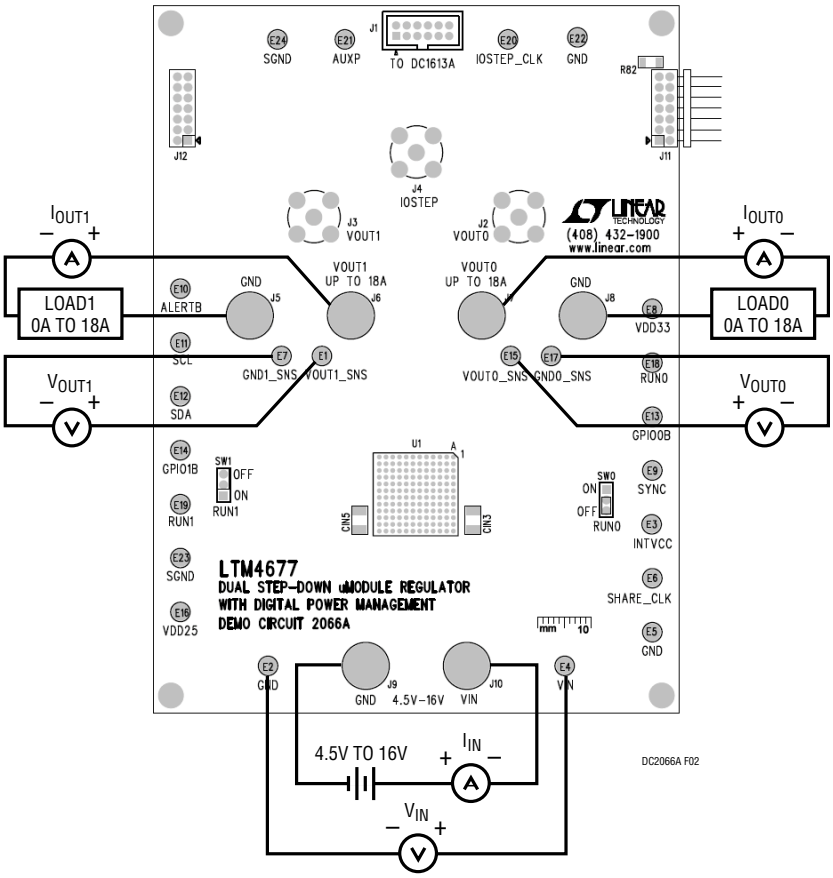


Figure 2. Proper Measurement Equipment Setup

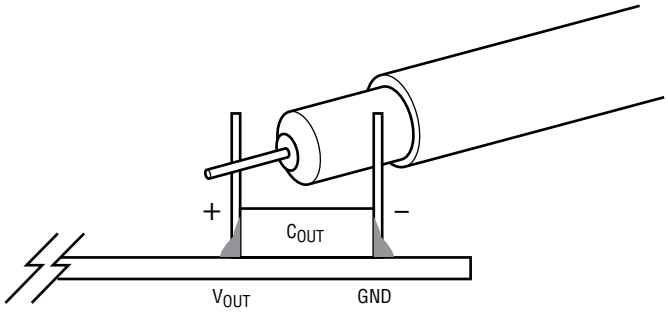


Figure 3. Measuring Output Voltage Ripple

QUICK START PROCEDURE

Connecting a PC to DC2066A

You can use a PC to reconfigure the power management features of the LTM4677 such as: nominal V_{OUT}, margin set points, OV/UV limits, temperature fault limits, sequencing parameters, the fault log, fault responses, GPIOs and other functionalities. The DC1613A dongle may be plugged when V_{IN} is present.

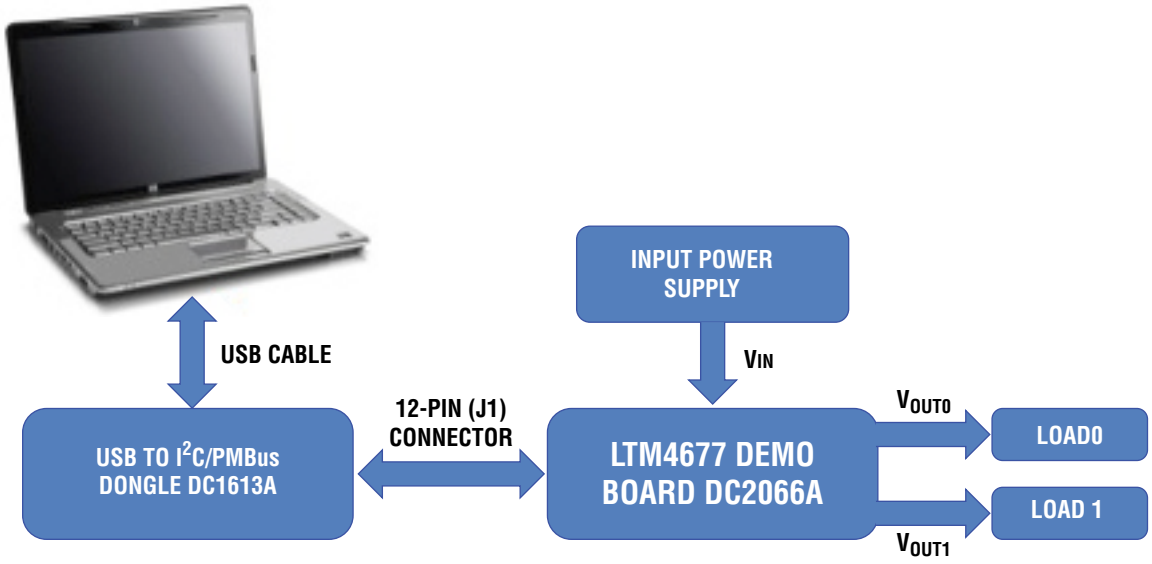


Figure 4. Demo Setup with PC

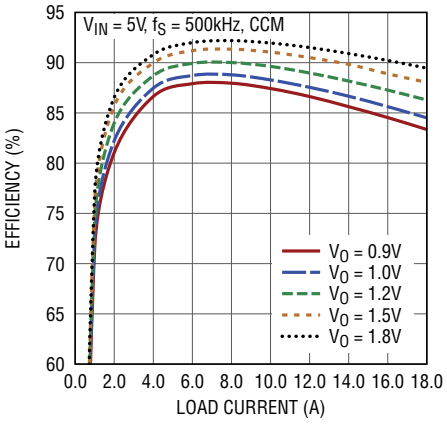


Figure 5. Efficiency vs Load Current at V_{IN} = 5V

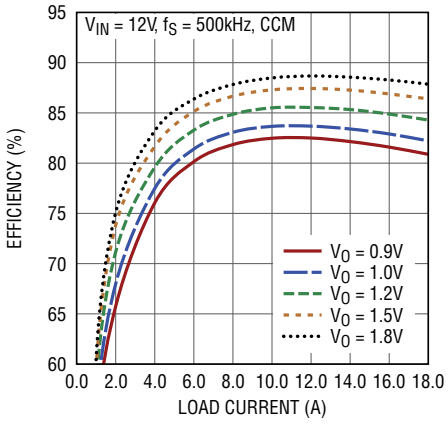


Figure 6. Efficiency vs Load Current at V_{IN} = 12V

QUICK START PROCEDURE

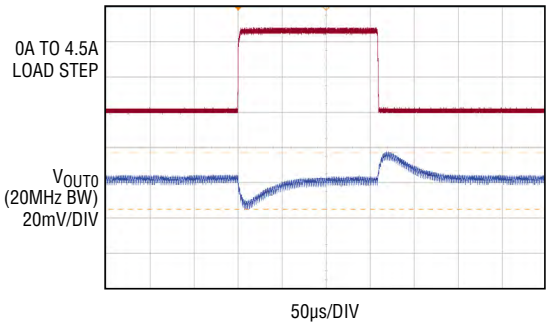


Figure 7. Output Voltage V_{OUT0} vs Load Current (V_{OUT0} = 1.0V), Measured by 1X Probe on C_{OUT8}

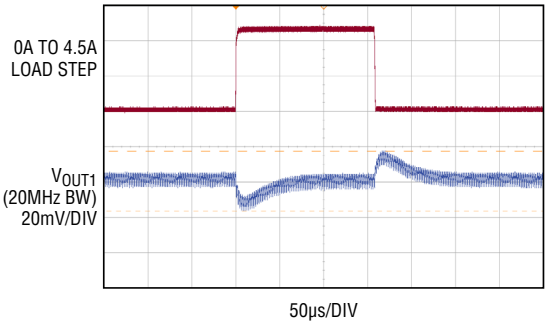


Figure 8. Output Voltage V_{OUT1} vs Load Current (V_{OUT1} = 1.8V), Measured by 1X Probe on C_{OUT3}

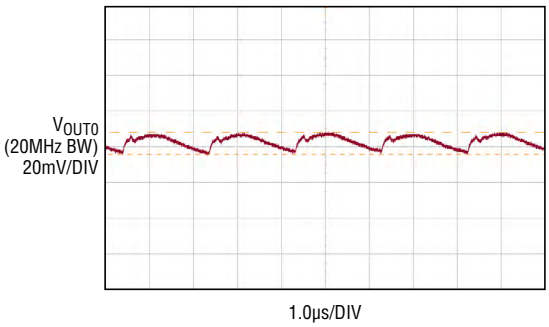


Figure 9. Output Voltage Ripple at V_{IN} = 12V, V_{OUT0} = 1.0V, I_{OUT0} = 18A, Measured by 1X Probe on C_{OUT8}

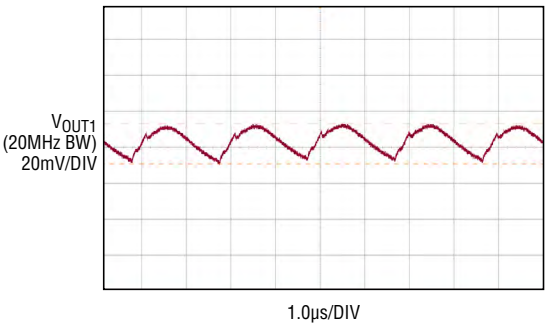


Figure 10. Output Voltage Ripple at V_{IN} = 12V, V_{OUT1} = 1.8V, I_{OUT1} = 18A, Measured by 1X Probe on C_{OUT3}

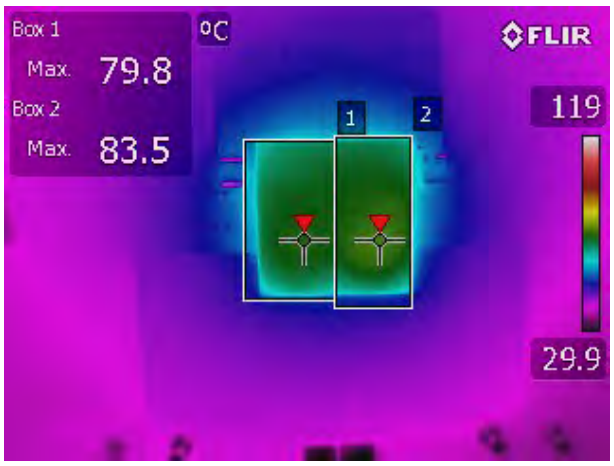


Figure 11. Thermal at V_{IN} = 12V, V_{OUT0} = 1.0V, I_{OUT0} = 18A, V_{OUT1} = 1.8V, I_{OUT1} = 18A, T_A = 25°C, 200LFM Airflow

LTpowerPlay SOFTWARE GUI

LTpowerPlay is a powerful Windows based development environment that supports Linear Technology power system management ICs and µModules, including the LTM4675, LTM4676, LTM4677, 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 USB-to-SMBus controller to communicate with one of many potential targets, including the LTM4675, LTM4676, LTM4677, LTC3880, LTC3882, 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.

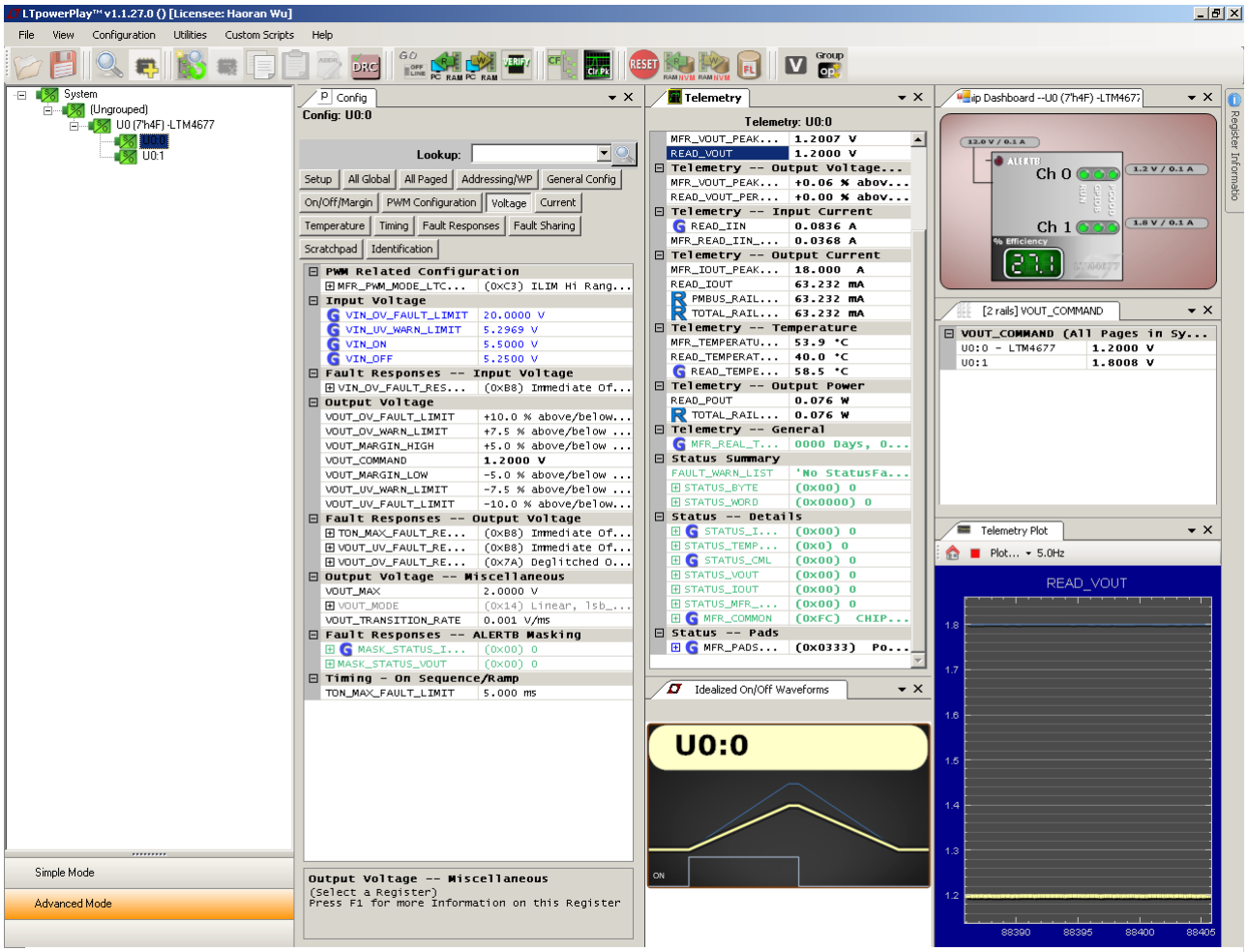


Figure 12. LTpowerPlay Main Interface

LTpowerPlay QUICK START GUIDE

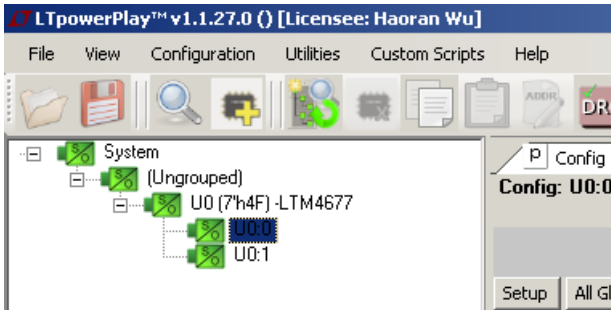
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTM4677.

1.Download and install the LTpowerPlay GUI:

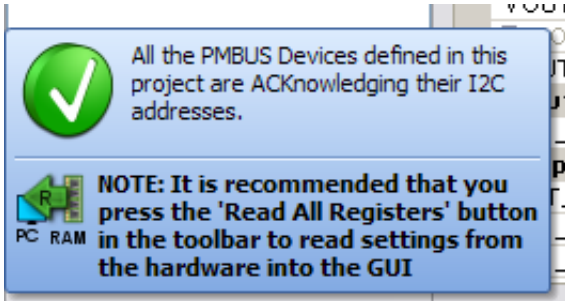
http://linear.com/ltpowerplay

2. Launch the LTpowerPlay GUI.

a. The GUI should automatically identify the DC2066A. The system tree on the left hand side should look like this:

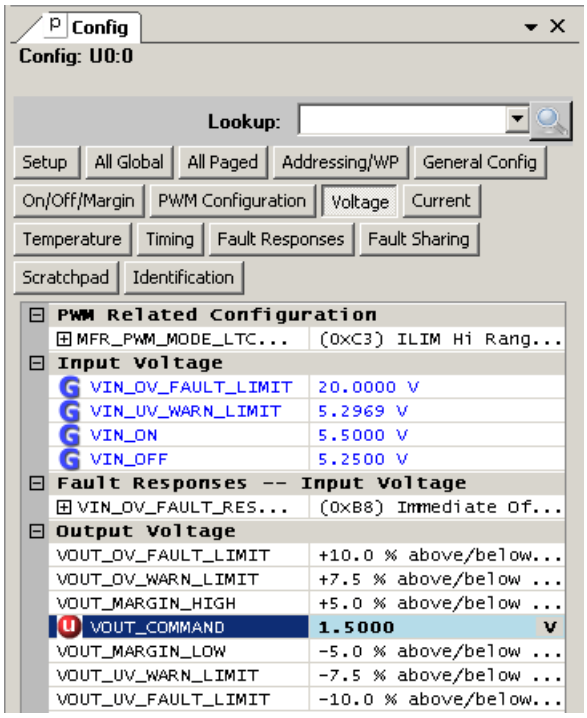


b. A blue message box shows for a few seconds in the lower left hand corner, confirming that LTM4677 is communicating:



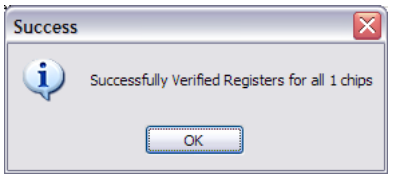
c. In the Toolbar, click the “R” (RAM to PC) icon to read the RAM from the LTM4677. This reads the configuration from the RAM of LTM4677 and loads it into the GUI.

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 LTM4677. 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 ELECTRONIC INDUSTRIES, 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	6	COUT4, COUT5, COUT9-12	CAP., 470µF, 2.5V, SP-CAP, D SIZE	PANASONIC, EEFGX0E471R
5	1	C26	CAP., X5R, 100nF, 16V, 10%, 0603	AVX, 0603YD104KAT
6	2	C27, C28	CAP., X7R, 10nF, 25V, 5%, 0603	AVX, 06033C103JAT
7	1	C23	CAP., X7R, 1µF, 25V, 10%, 0805	AVX, 08053C105KAT2A
8	3	C21, C22, C24	CAP., X5R, 1µF, 25V, 10%, 0603	AVX, 06033D105KAT2A
9	12	R10-R16, R18, R19, R24, R52, R77	RES., CHIP, 10k, 1%, 0603	NIC, NRC06F1002TRF
10	1	R30	RES., CHIP, 6.34k, 1%, 0603	VISHAY, CRCW06036K34FKEA
11	2	R72, R73	RES., CHIP, 4.99k, 1%, 0603	NIC, NRC06F4991TRF
12	1	U1	I.C., LTM4677EY#PBF	LINEAR TECH., LTM4677EY#PBF
13	1	U2	I.C., EEPROM SERIAL-I^{2}C, 2k-BIT, I.C., TSSOP-8	MICROCHIP, 24LC025-I/ST
14	2	R2, R22	RES., CHIP, 17.8k, 1%, 0603	VISHAY, CRCW060317K8FKEA
15	2	C1, C14	CAP., X7R, 1.8nF, 25V, 5%, 0603	AVX, 06033C182JAT2A
Additional Demo Board Circuit Components				
16	0	C2, C15-C17 (OPT)	CAP., 0603 OPTIONAL	
17	1	Q1	N-CHANNEL 30-V MOSFET	VISHAY, SUD50N03-09P
18	10	R3, R7, R9, R25, R31, R32, R33, R63, R65, R66	RES., CHIP, 0Ω, 1%, 0603	NIC, NRC06Z0000TRF
19	0	R8, R26, R27, R28, R29, R35, R38, R41, R61, R62, R64, R67, R68, R74, R75, R83, R88, R89, R6, R23 (OPT)	RES., 0603 OPTIONAL	
20	0	R17, R20, R49, R82 (OPT)	RES., CHIP OPTIONAL	
21	1	R48	RES., CHIP, 0Ω, 0.5W, 2010	NIC, NRC50ZOTRF
22	1	R53	RES., CHIP, 0.01Ω, 1/2W, 1%, 2010	VISHAY, WSL2010R0100FEA
23	2	R69, R70	RES., CHIP, 10Ω, 1%, 0603	NIC, NRC06F10R0TRF
24	1	R78	RES., CHIP, 15.8k, 1%, 0603	NIC, NRC06F1582TRF
25	0	D1, D2 (OPT)	DIODE OPTIONAL	
26	1	Q19	MOSFET P-CH 20V 0.58A SOT-23	VISHAY TP0101K-T1-E3
Hardware: For Demo Board Only				
27	2	SW0, SW1	HEADER 3 PIN 0.079 SINGLE ROW	SAMTEC, TMM103-02-L-S
28	3	J2-J4	CONN, BNC, 5 PINS	CONNEX, 112404
29	1	J1	CONN HEADER 12POS 2mm STR DL PCB	FCI 98414-G06-12ULF
30	24	E1-E24	TESTPOINT, TURRET, 0.062"	MILL-MAX, 2308-2-00-80-00-00-07-0
31	6	J5-J10	BANANA SMALL	KEYSTONE, 575-4
32	2	XJP1, XJP2	SHUNT	SAMTEC, 2SN-BK-G
33	4	(STAND-OFF)	STAND-OFF, NYLON 0.50" tall	KEYSTONE, 8833(SNAP ON)
34	1	J12	CONN RECEPT 2mm DUAL R/A 14POS	SULLINS, NPPN072FJFN-RC
35	1	J11	CONN HEADER 14POS 2mm R/A GOLD	MOLEX, 87760-1416

SCHEMATIC DIAGRAM

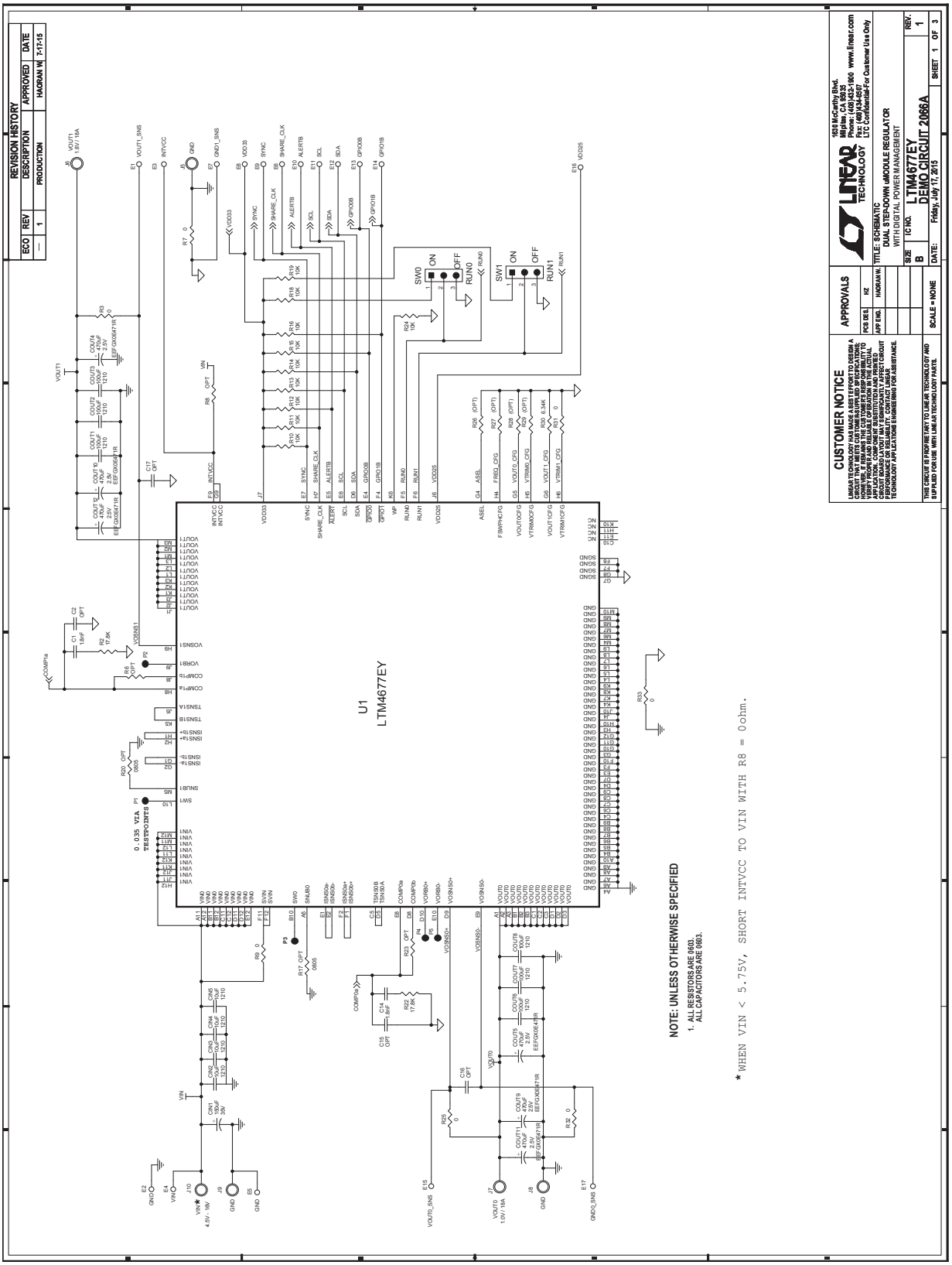


Figure 12. DC2066A Demo Circuit Schematic, Page 1

SCHEMATIC DIAGRAM

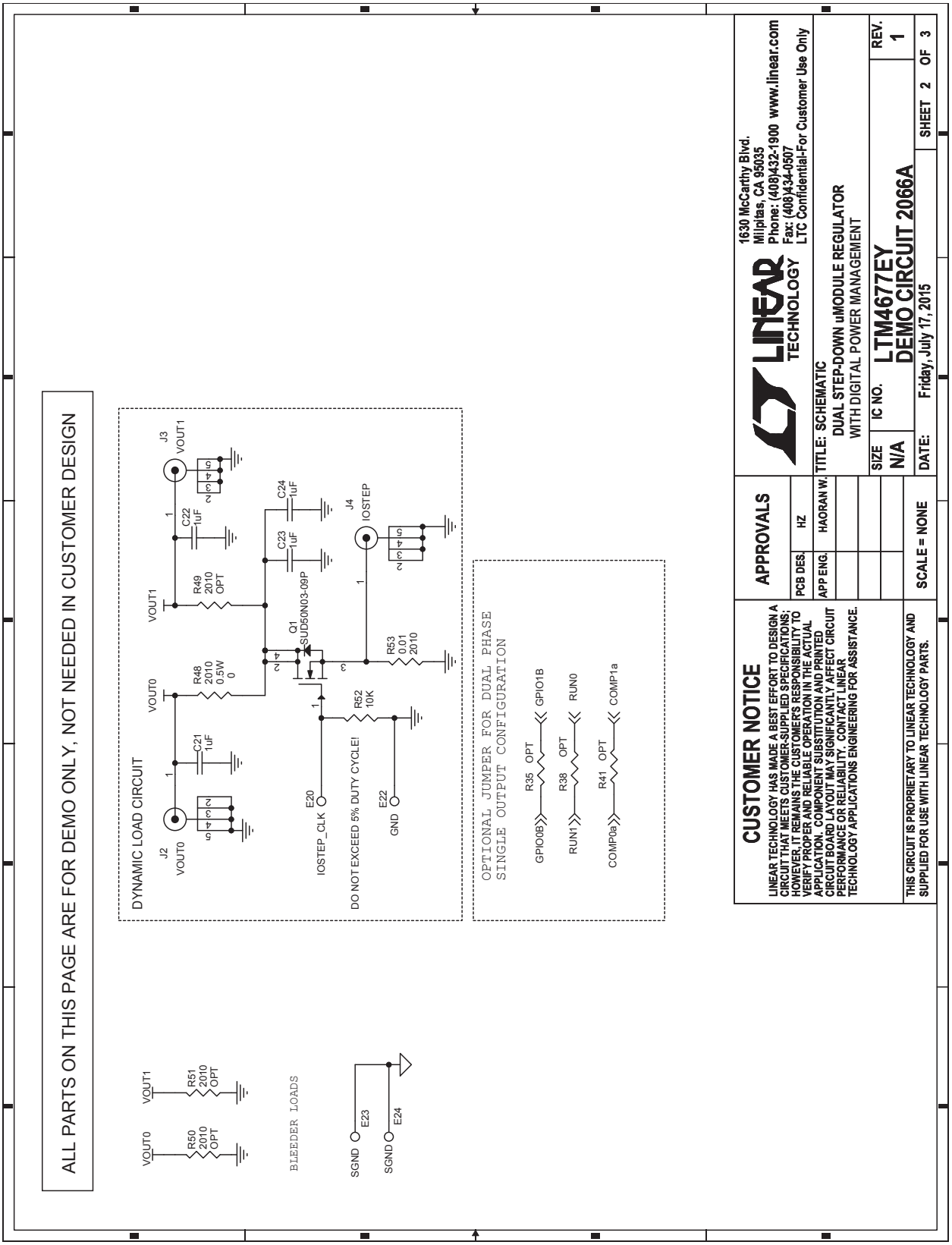


Figure 13. DC2066A Demo Circuit Schematic, Page 2

SCHEMATIC DIAGRAM

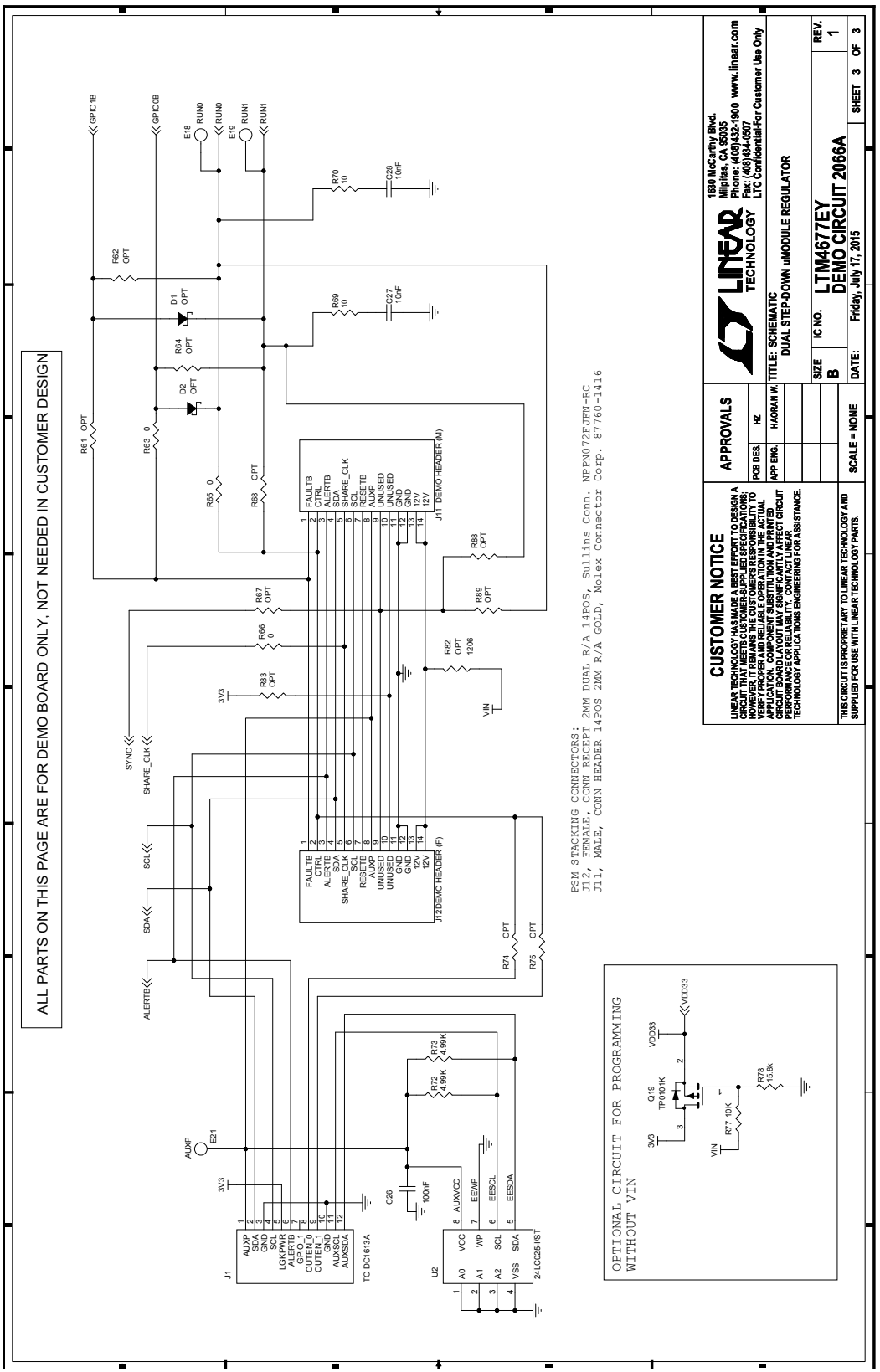


Figure 14. DC2066A Demo Circuit Schematic, Page 3

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

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.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged**.

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

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