LTM4680EY
Dual 30A or Single 60A µModule Regulator with Digital Power System Management

DESCRIPTION

Demonstration circuit 2845A features the LTM®4680, which is a dual 30A or single 60A µModule® regulator with 4.5V to 16V input range. The two channels of the LTM4680 are paralleled on this board, so it can deliver 60A maximum load current. The output voltage is adjustable from 0.5V to 3.3V. Please see LTM4680 data sheet for more detailed information.

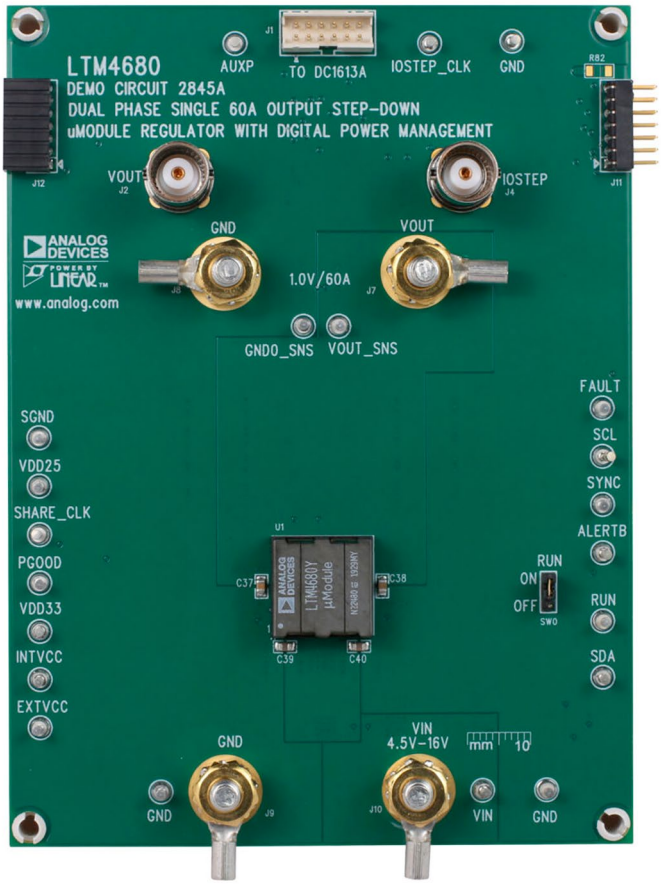
DC2845A powers up to default settings and produces power based on configuration resistors without the need for any serial bus communication. This allows easy evaluation of the DC/DC converter. To fully explore the extensive power system management features of the part, download the GUI software LTpowerPlay® onto your PC and use ADI 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.

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.

BOARD PHOTO

Part marking is either ink mark or laser mark



PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		4.5		16	V
Output Voltage, V_{OUT}	V_{IN} = 4.5V to 16V, I_{OUT} = 0A to 60A	0.5	1.0	3.3	V
Maximum Output Current, I_{OUT}	V_{IN} = 4.5V to 16V, V_{OUT} = 0.5V to 3.3V		60		A
Typical Efficiency	V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 60A		88.4 (See Figure 5)		%
Default Switching Frequency			500		kHz

QUICK START PROCEDURE

Table 1. LTM4680 Demo Boards for Up to 120A Point-of-Load Regulation

MAXIMUM OUTPUT CURRENT	NUMBER OF OUTPUTS	NUMBER OF LTM4680 µModule REGULATORS ON THE BOARD	DEMO BOARD PART NUMBER
30A/30A	2	1	DC2844A
120A	1	2	DC2863A

Demonstration circuit 2845A is easy to set up to evaluate the performance of the LTM4680EY. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below.

1. With power off, connect the input power supply to VIN (4.5V to 16V) and GND (input return).
2. Connect the 1.0V output load between VOUT and GND (Initial load: no load).
3. Connect the DVMs to the input and output. Set default jumper position:

   JP1: RUN1 ON
4. Turn on the input power supply and check for the proper output voltage. VOUT should be 1.0V ±0.5%.
5. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage and other parameters.
6. Connect the dongle and control the output voltages from the GUI. See LTpowerPlay Quick Start Guide section for details.

   NOTE: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 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

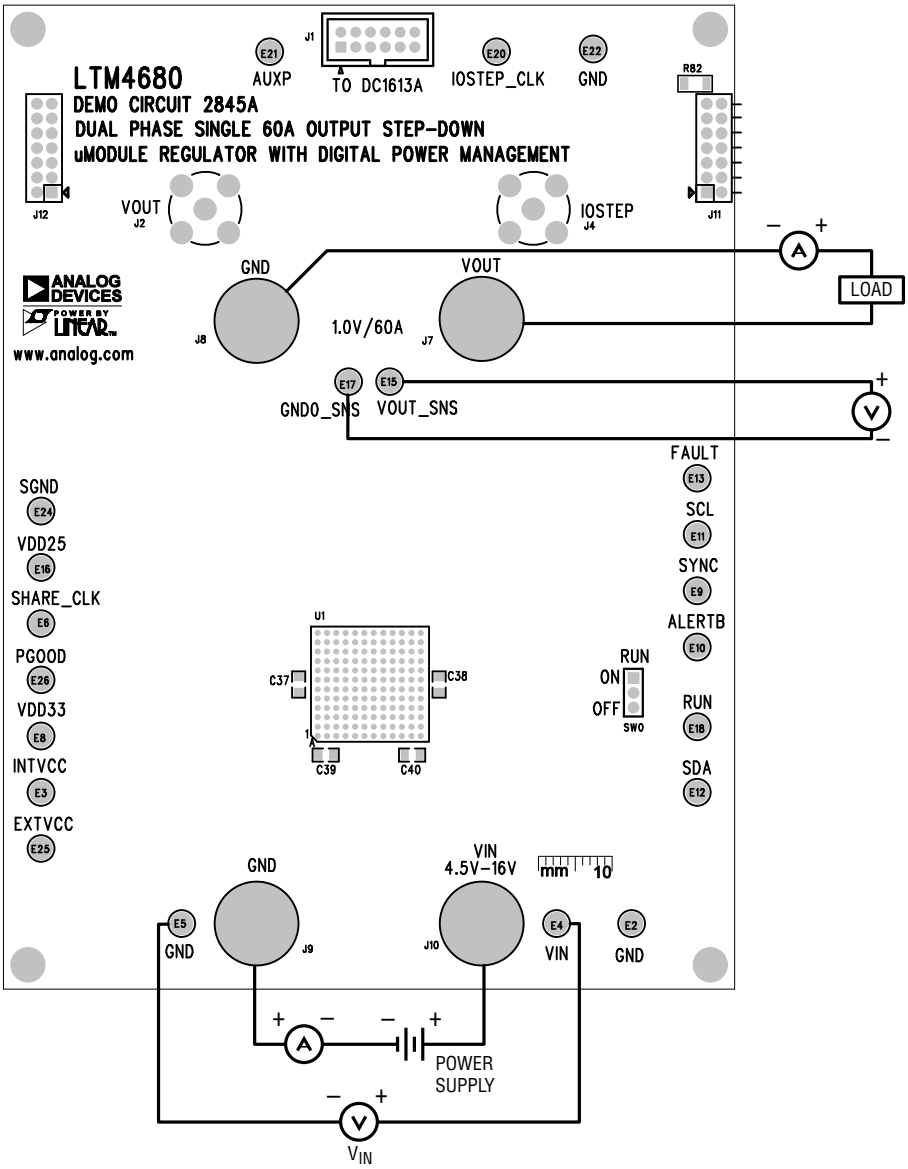


Figure 1. Proper Measurement Equipment Setup

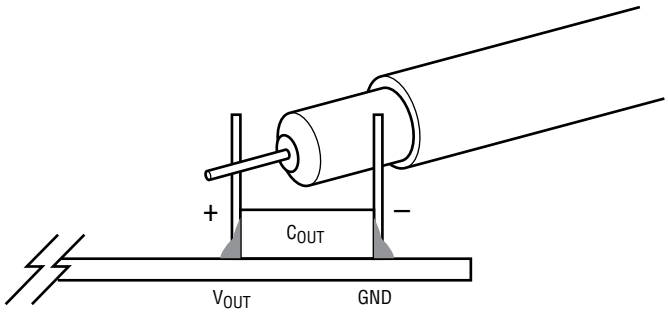


Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

Connecting a PC to DC2845A

You can use a PC to reconfigure the power management features of the LTM4680 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.

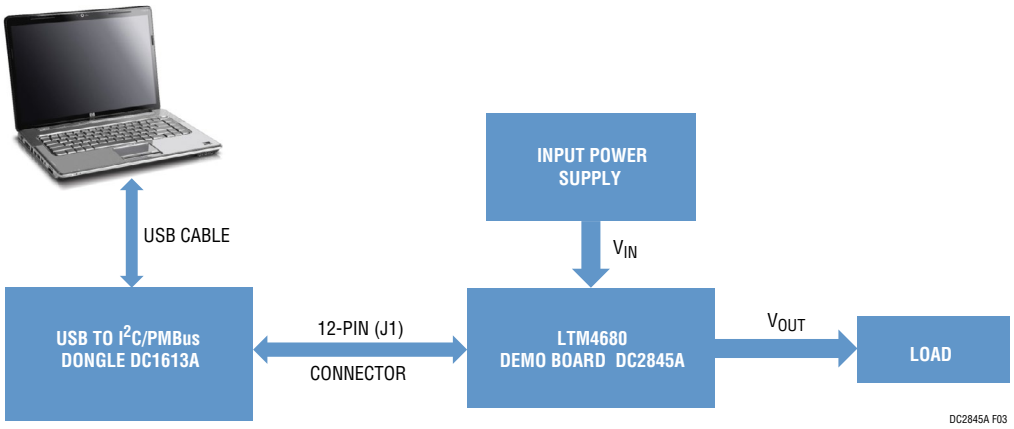


Figure 3. Demo Setup with PC

TEST RESULTS

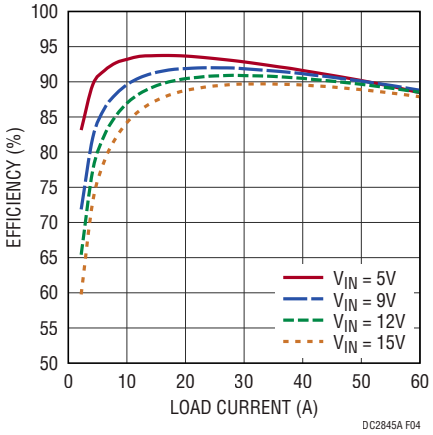
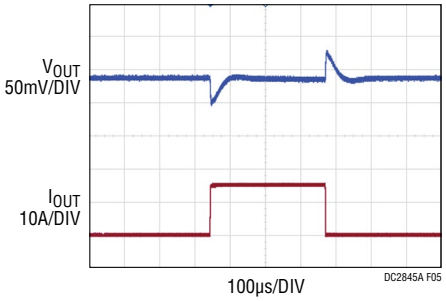
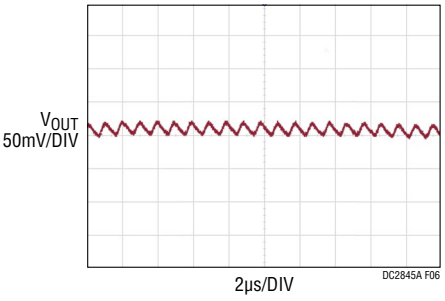


Figure 4. Efficiency vs Load Current



V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 15A TO 30A

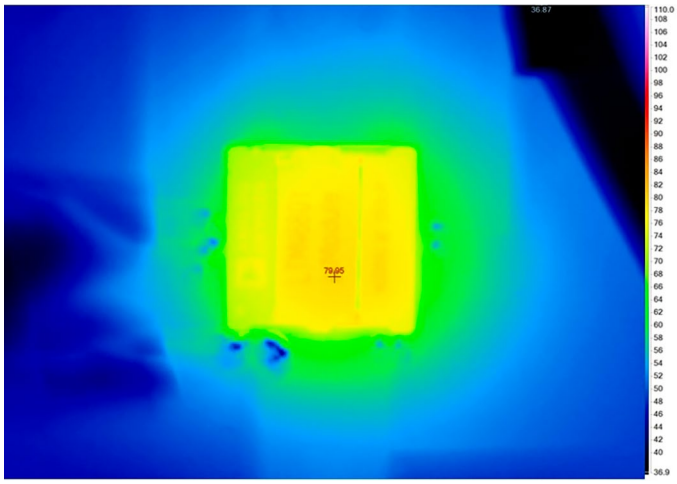
Figure 5. V_{OUT} Load Transient Response



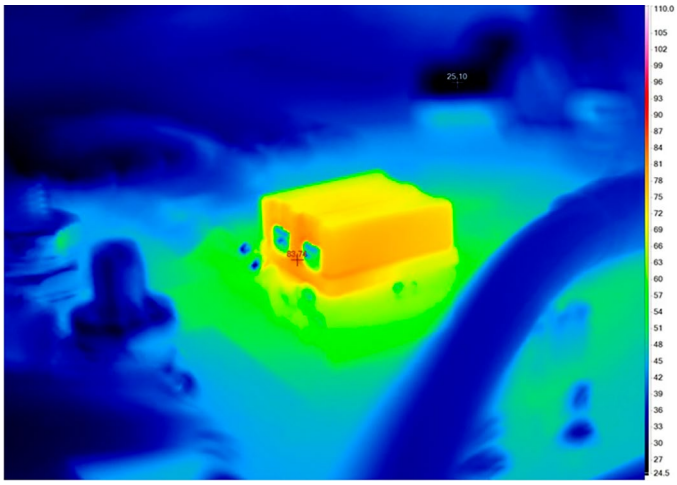
V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 60A

Figure 6. V_{OUT} Voltage Ripple

TEST RESULTS



(a) Top View



(b) Side View

Figure 7. Thermal at V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 60A, T_A = 25°C, No Airflow

LTpowerPlay QUICK START GUIDE

LTpowerPlay is a powerful Windows-based development environment that supports Analog Devices power system management ICs and µModule(s), including LTM4675, LTM4676A, LTM4677, LTM4678, LTM4680, LTM4686, LTM4700, LTC3880, LTC3882, LTC3883, LTC3884 and LTC3887. 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 LTM4675, LTM4676A, LTM4677, LTM4678, LTM4680, LTM4686, LTM4700, LTC3880, LTC3882, LTC3883, LTC3884 and LTC3887'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 here.

To access technical support documents for Analog Devices digital power products visit the LTpowerPlay Help menu. Online help also available through the LTpowerPlay.

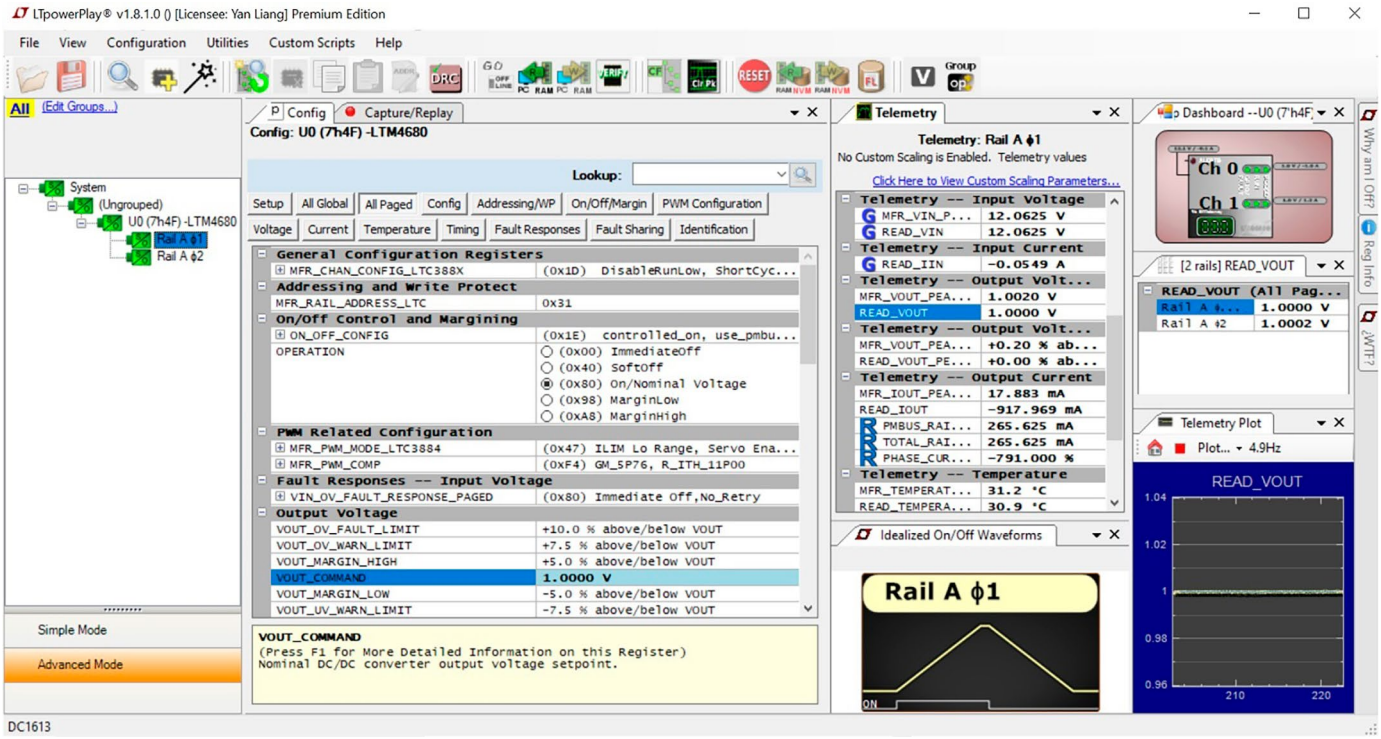


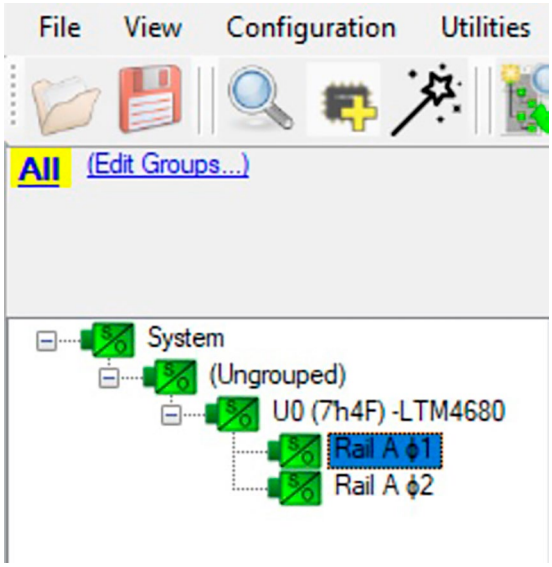
Figure 8. LTpowerPlay Main Interface

LTpowerPlay QUICK START GUIDE

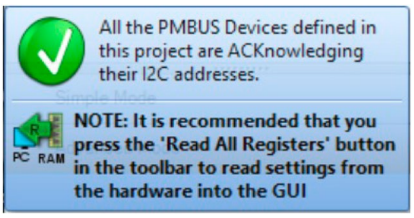
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTM4680.

1. Download and install the LTpowerPlay GUI.
2. Launch the LTpowerPlay GUI.

   a. The GUI should automatically identify the DC2845A. The system tree on the left hand side should look like this:

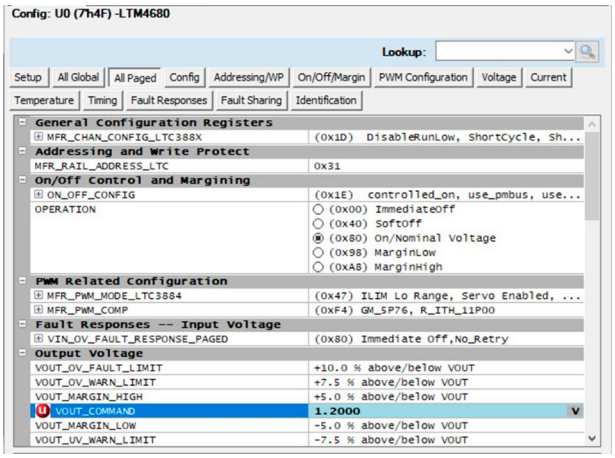


   b. A message box shows for a few seconds in the lower left hand corner, confirming that LTM4680 is communicating:



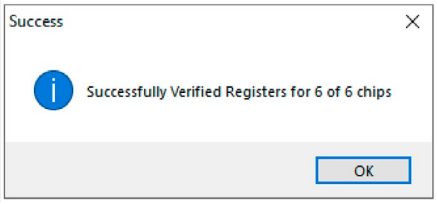
   c. In the Toolbar, click the “R” (RAM to PC) icon to read the RAM from the LTM4680. This reads the configuration from the RAM of LTM4680 and loads it into the GUI:

   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 LTM4680. 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” icon:

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

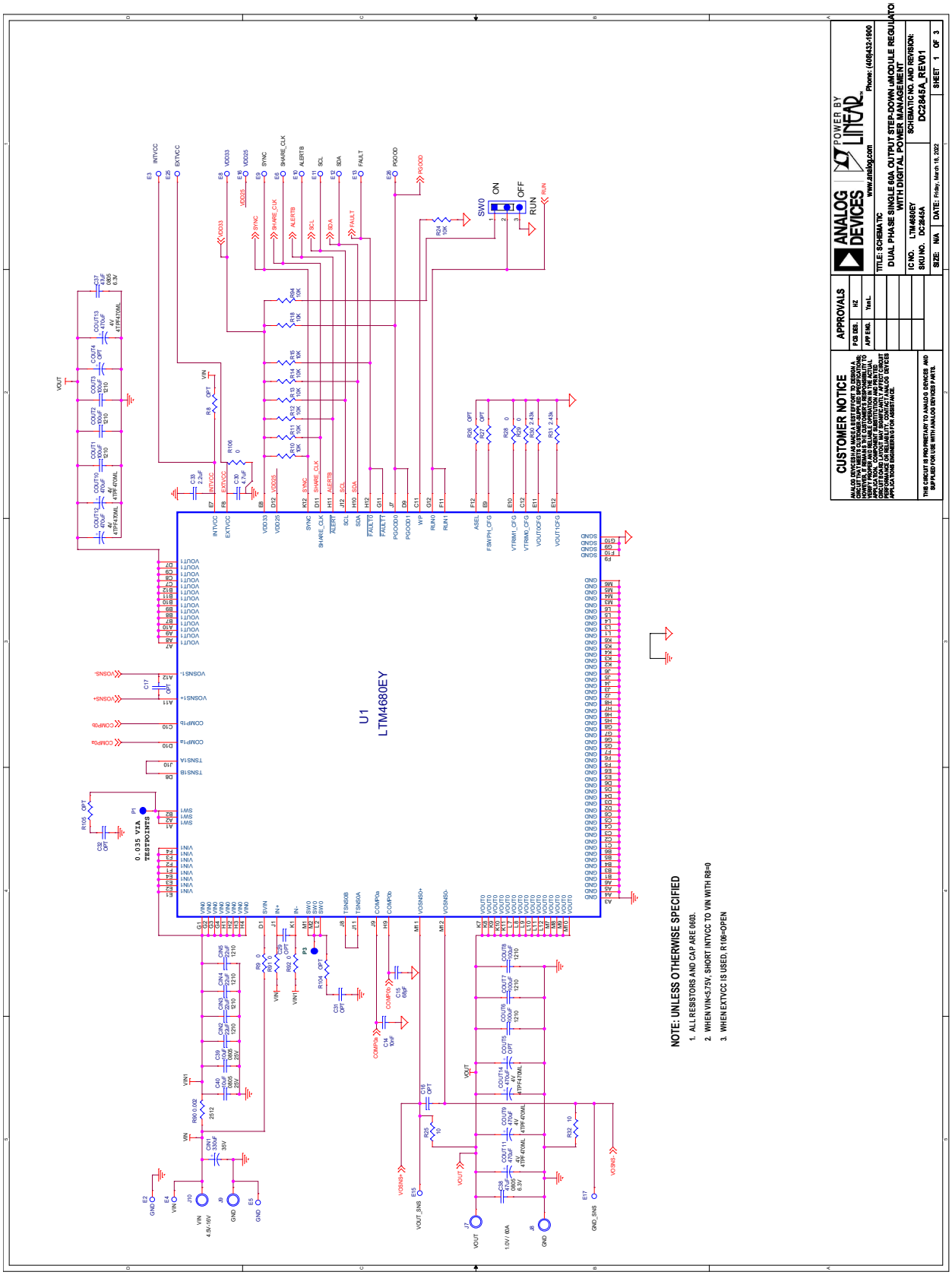
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C37, C38	CAP., 47µF, X5R, 6.3V, 20%, 0805	MURATA, GRM21BR60J476ME15L
2	6	COUT1, COUT2, COUT3, COUT6, COUT7, COUT8	CAP., 100µF, X5R, 6.3V, 20%, 1210	MURATA, GRM32ER60J107ME20L
3	1	C33	CAP., 2.2µF, X5R, 6.3V, 10%, 0603	MURATA, GRM188R60J225KE19D
4	4	CIN2, CIN3, CIN4, CIN5	CAP., 22µF, X5R, 35V, 20%, 1210	TAIYO YUDEN, GMK325BJ226MM-P
5	1	C15	CAP., 68pF, NP0, 25V, 5%, 0603	KEMET, C0603C680J3GACTU
6	1	C14	CAP., 4700pF, X7R, 25V, 5%, 0603	KEMET, C0603C472J3RACTU
7	6	COUT9, COUT10, COUT11, COUT12, COUT13, COUT14	CAP., 470µF, TANT. POSCAP, 4V, 20%, 7343, 10mΩ	PANASONIC, 4TPF470ML
8	2	C39, C40	CAP., 10µF, X5R, 25V, 10%, 0805	AVX, 08053D106KAT2A
9	9	R10, R11, R12, R13, R14, R15, R18, R24, R94	RES., 10k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060310K0FKEA
10	2	R25, R32	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
11	2	R30, R31	RES., 2.43k, 1%, 1/10W, 0603	VISHAY, CRCW06032K43FKEAC
12	1	U1	IC, HIGH EFFICIENCY, PolyPhase®, BGA	ANALOG DEVICES, LTM4680EY#PBF
Additional Demo Board Circuit Components				
1	0	COUT4, COUT5	CAP., OPTION, 7343	
2	1	C30	CAP., 4.7µF, X5R, 6.3V, 10%, 0603	MURATA, GRM188R60J475KE19D
3	2	C34, C35	CAP., 100µF, X5R, 6.3V, 20%, 1210	MURATA, GRM32ER60J107ME20L
4	1	CIN1	CAP., 330µF, ALUM, POLY, 35V, 20%, RADIAL, SMD, AEC-Q200	PANASONIC, EEH-ZK1V331P
5	1	C23	CAP., 1µF, X7R, 25V, 10%, 0805	AVX, 08053C105KAT2A
6	0	C16, C17, C29, C31, C32	CAP., OPTION, 0603	
7	1	C28	CAP., 0.01µF, X7R, 25V, 5%, 0603	AVX, 06033C103JAT2A
8	3	C21, C24, C36	CAP., 1µF, X5R, 25V, 10%, 0603	AVX, 06033D105KAT2A
9	1	C26	CAP., 0.1µF, X5R, 16V, 10%, 0603	AVX, 0603YD104KAT2A
10	1	R53	RES., 0.01Ω, 1%, 1/2W, 2010, METAL, SENSE, AEC-Q200	VISHAY, WSL2010R0100FEA
11	9	R9, R63, R65, R66, R91, R92, R106, R28, R29	RES., 0Ω, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
12	1	R78	RES., 15.8k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060315K8FKEA
13	1	R90	RES., 0.001Ω, 1%, 2W, 2512, AEC-Q200, CURRENT SENSE	BOURNS, CRF-2512-FZ-R001ELF
14	2	R52, R77	RES., 10k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060310K0FKEA
15	1	R70	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
16	2	R72, R73	RES., 4.99k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06034K99FKEA
17	0	R8, R26, R27, R64, R74, R75, R83, R104, R105, R107	RES., OPTION, 0603	

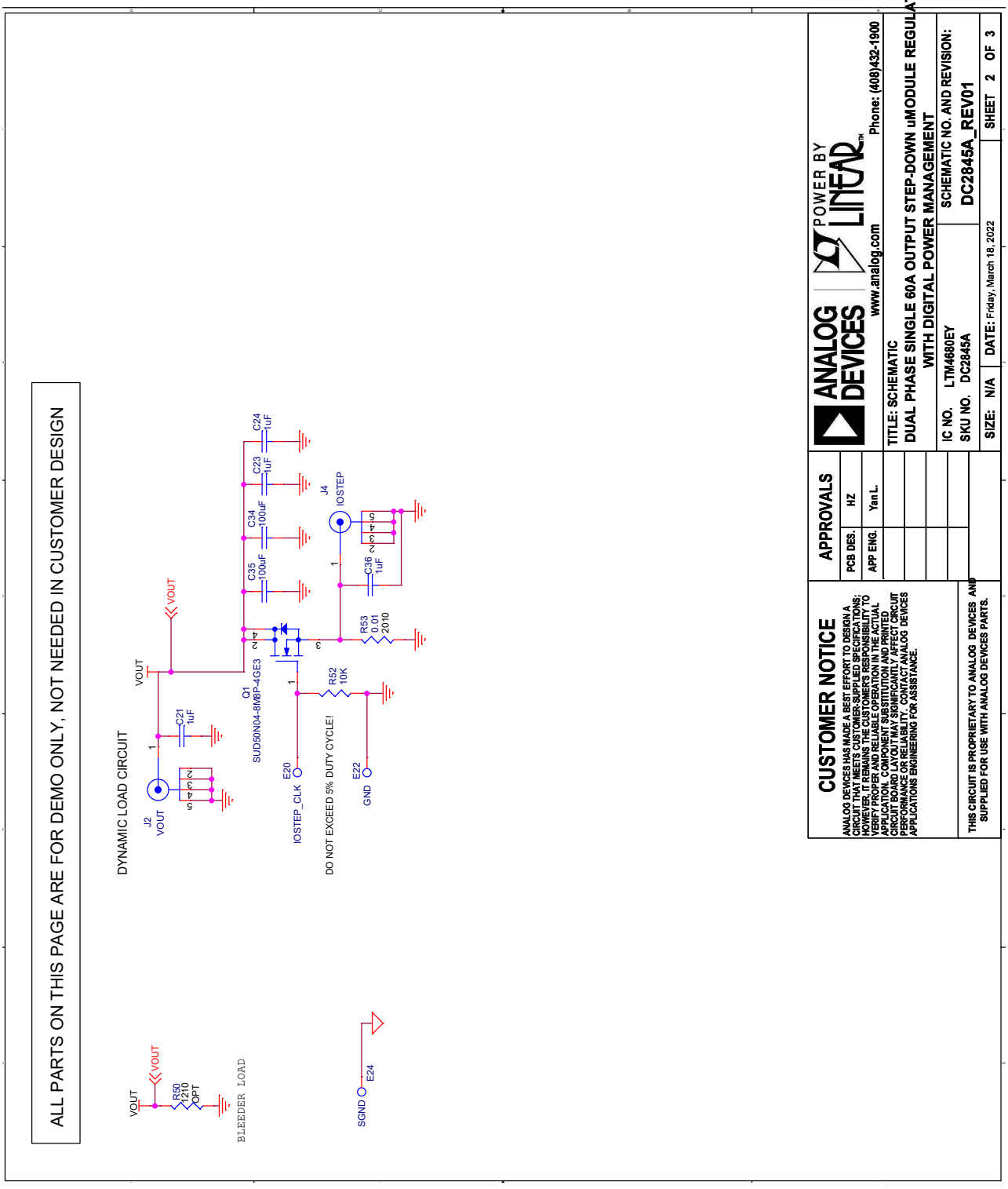
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
18	0	R82	RES., OPTION, 1206	
19	0	R50	RES., OPTION, 1210	
20	0	D2	DIODE, OPTION, SOD-323	
21	1	Q1	XSTR., MOSFET, N-CH, 40V, 14A, DPAK (TO-252)	VISHAY, SUD50N04-8M8P-4GE3
22	1	Q19	XSTR., MOSFET, P-CH, 20V, 5.9A, SOT-23-3 (TO-236-3)	VISHAY, Si2365EDS-T1-GE3
23	1	U2	IC, MEMORY, EEPROM, 2kb (256×8), TSSOP-8, 400kHz	MICROCHIP, 24LC025-I/ST
Hardware: For Demo Board Only				
1	1	SW0	CONN., HDR, MALE, 1×3, 2mm, VERT, ST, THT	SULLINS CONNECTOR SOLUTIONS, NRPN031PAEN-RC
2	4	J7, J8, J9, J10	STUD, TEST PIN	PEM, KFH-032-10
3	8	J7, J8, J9, J10 (×2)	NUT, BRASS 10-32	ANY, #10-32M/S
4	4	J7, J8, J9, J10	RING, LUG #10	KEYSTONE, 8205
5	4	J7, J8, J9, J10	WASHER, TIN PLATED BRASS	ANY, #10
6	1	XJP1	CONN., SHUNT, FEMALE, 2-POS, 2mm	SAMTEC, 2SN-BK-G
7	2	J2, J4	CONN., RF, BNC, RCPT, JACK, 5-PIN, ST, THT, 50Ω	AMPHENOL RF, 112404
8	1	J1	CONN., HDR, SHROUDED, MALE, 2×6, 2mm, VERT, ST, THT	AMPHENOL, 98414-G06-12ULF
9	1	J12	CONN., HDR, FEMALE, 2×7, 2mm, R/A THT	SULLINS CONNECTOR SOLUTIONS, NPPN072FJFN-RC
10	1	J11	CONN., HDR, MALE, 2×7, 2mm, R/A THT	MOLEX, 0877601416
11	21	E2-E6, E8-E13, E15-E18, E20-E22, E24-E26	TEST POINT, TURRET, 0.064" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2308-2-00-80-00-00-07-0
12	4	MH1, MH2, MH3, MH4	STANDOFF, NYLON, SNAP-ON, 0.50"	KEYSTONE, 8833

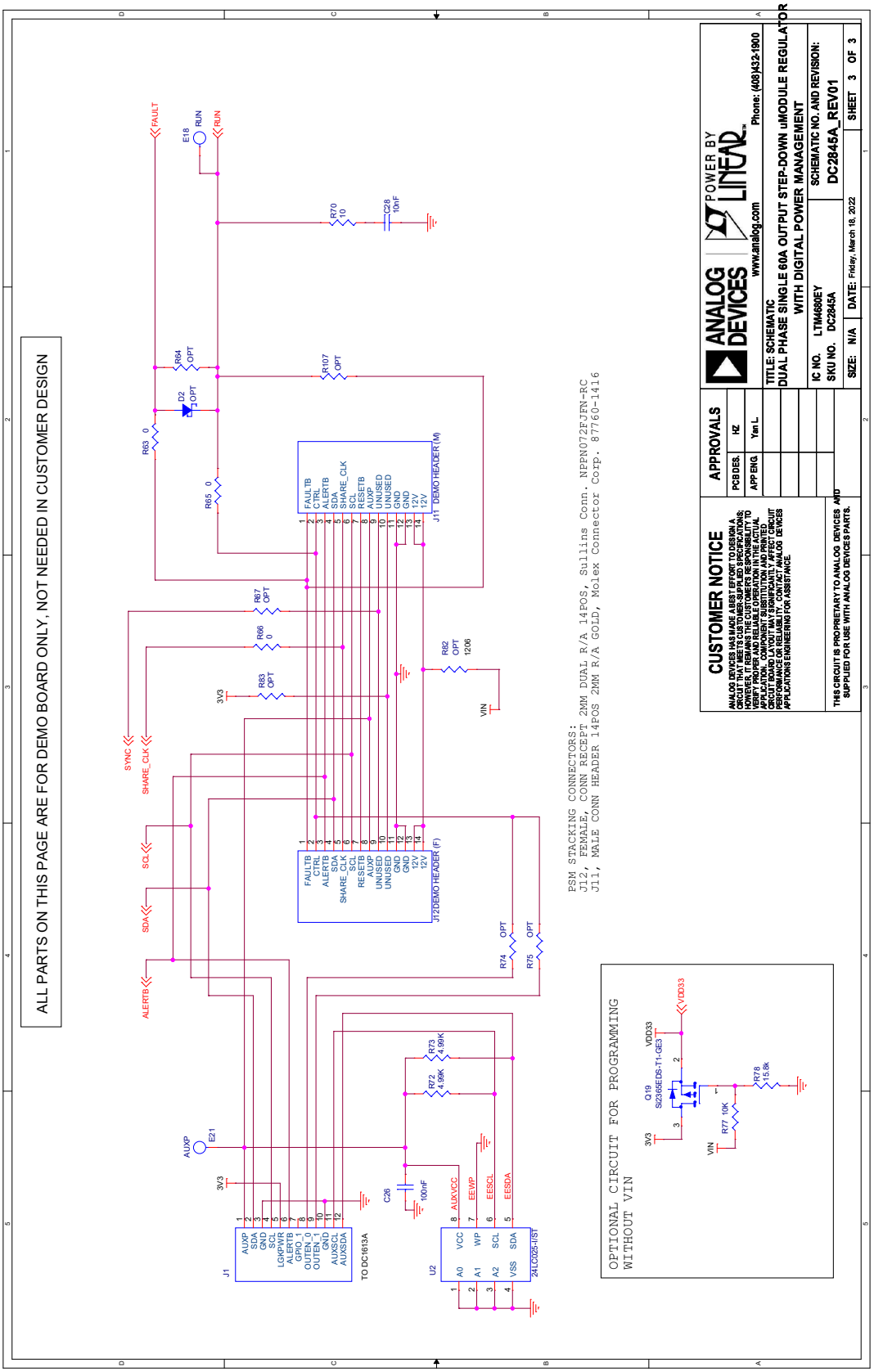
SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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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