LTC7050/LTC3884-1
2-Phase, Dual-Output Synchronous Buck Converter with Power System Management

DESCRIPTION

Demonstration circuit 2881A-A is a 2-phase dual-output, high efficiency, high density, synchronous buck converter with 7V to 14V input range. Each output can supply up to 30A maximum load current with 1V output. The demo board features the LTC®3884-1 controller paired with the LTC7050 dual smart power stage to provide a 2-phase buck converter solution. The LTC3884-1 is a dual output poly phase step-down controller with digital power system management. The LTC7050 is a dual monolithic smart power stage which integrates high speed drivers with low resistance half-bridge power switches plus comprehensive monitoring and protection circuitry in an electrically and thermally optimized package. Please refer to the LTC3884-1 and LTC7050 data sheet for more detailed information.

DC2881A-A powers up to default settings and produces power based on configuration resistors (or with the setting in its non-volatile 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 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 here.

For more details and instructions of LTpowerPlay, please refer to LTpowerPlay Quick Start Procedure.

Design files for this circuit board are available.

BOARD PHOTO

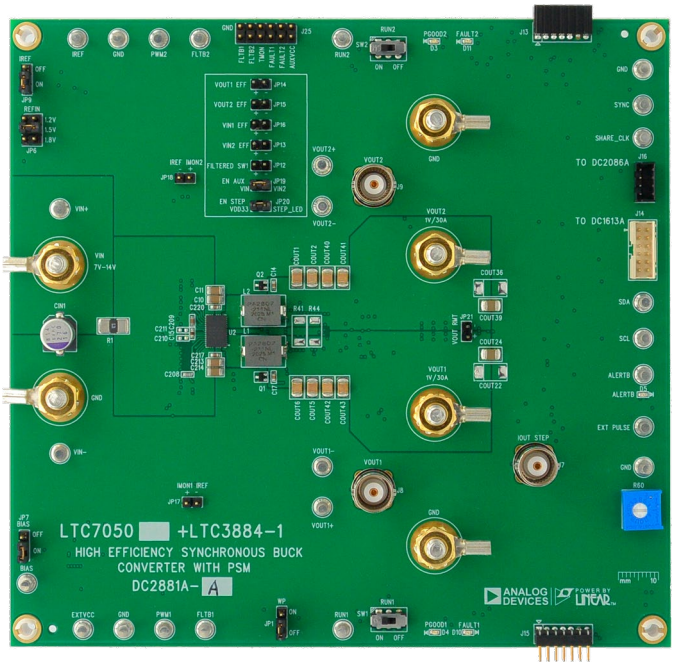


Figure 1. Dual-Output LTC7050 + LTC3884-1/DC2881A-A Demo Circuit

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Voltage Range		7	12	14	V
Output Voltage, $V_{OUT1/2}$	V_{IN} = 7 to 14V, $I_{OUT1/2}$ = 0A to 30A	0.6	1	1.8	V
Maximum Output Current, $I_{OUT1/2}$	V_{IN} = 7 to 14V, $V_{OUT1/2}$ = 0.6V to 1.8V		30		A
Typical Efficiency of $V_{OUT1/2}$	V_{IN} = 12V, $V_{OUT1/2}$ = 1V, $I_{OUT1/2}$ = 30A		89.5		%
Default Switching Frequency			500		kHz

QUICK START PROCEDURE

DC2881A-A is easy to set up to evaluate the performance of LTC7050 and LTC3884-1. Refer to Figure 2 for the proper measurement equipment setup and follow the procedure below.

1. With power off, connect the input power supply (7-14V) to VIN (J1) and GND (J2).
2. Connect the 1.0V output load (Initial load: no load) between VOUT1 (J5) and GND (J6).
3. Connect the 1.0V output load (Initial load: no load) between VOUT2 (J3) and GND (J4).
4. Connect the DMMs to the input and outputs. Set default jumper position:
   - JP1: ON
   - JP6: 1.5V
   - JP7: ON
   - JP9: ON
   - JP19: ON
   - JP20: ON
   - SW1 RUN1: ON
   - SW2 RUN2: ON
5. Turn on the input power supply and check for the proper output voltages. V_{OUT1} should be 1V ±0.5% and V_{OUT2} should be 1V ±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 Quick Start Procedure 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.

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

The dual outputs can be configured to run separately or together as a single output. The dynamic load is connected to channel 1 by default. It can be connected to channel 2 by changing R196 and R197. Refer to page 1 of schematic for more details.

When doing the load transient test, it is recommended to use a function generator to generate a pulse (~3% duty cycle with 10Hz~100Hz frequency). Then applying this pulse to the EXT PULSE (E7) and GND (E8) turrets. 100mV/A is the ratio of the pulse voltage amplitude over

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

the load current step. The maximum load current step achievable is typically 25A. The dynamic circuit MOSFET is off when EXT PULSE is floating or grounded. Apply around 30mV of initial value to EXT PULSE to make the MOSFET open before the pulse, so that the slew rate of load current will follow the slew rate of EXT PULSE linearly. Refer to the table in the schematic file to optimally route the voltage sense points during load transient test. It is highly recommended to monitor the load voltage using JP21, which is Kelvin connected to C227.

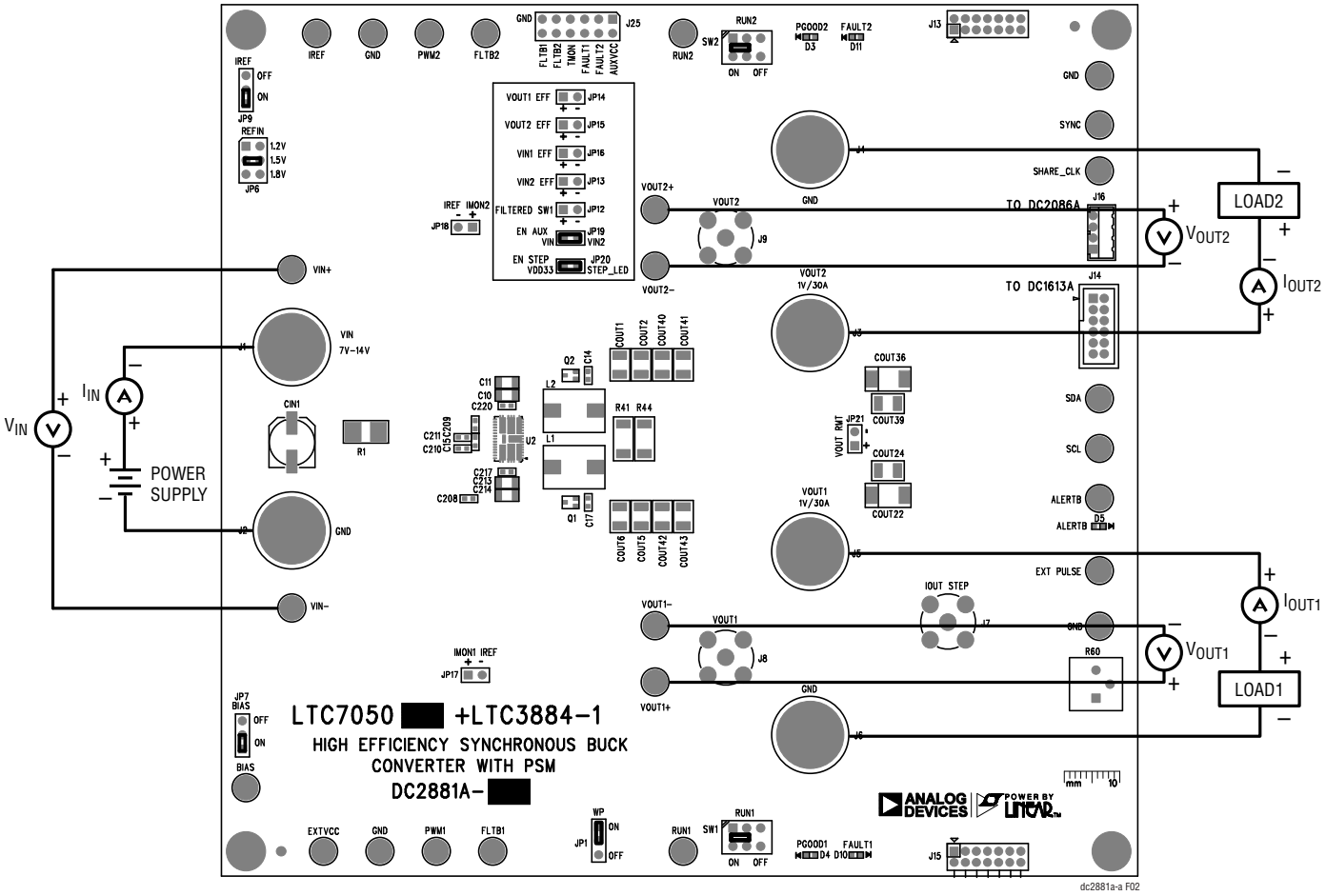


Figure 2. Proper Measurement Equipment Setup

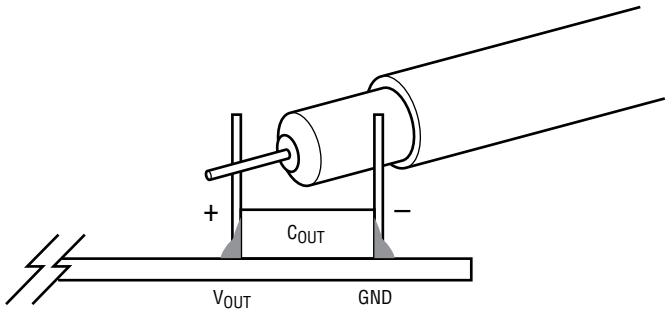


Figure 3. Measuring Output Voltage Ripple

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

Connecting a PC to DC2881A-A

You can use a PC to reconfigure the power management features of LTC3884-1 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.

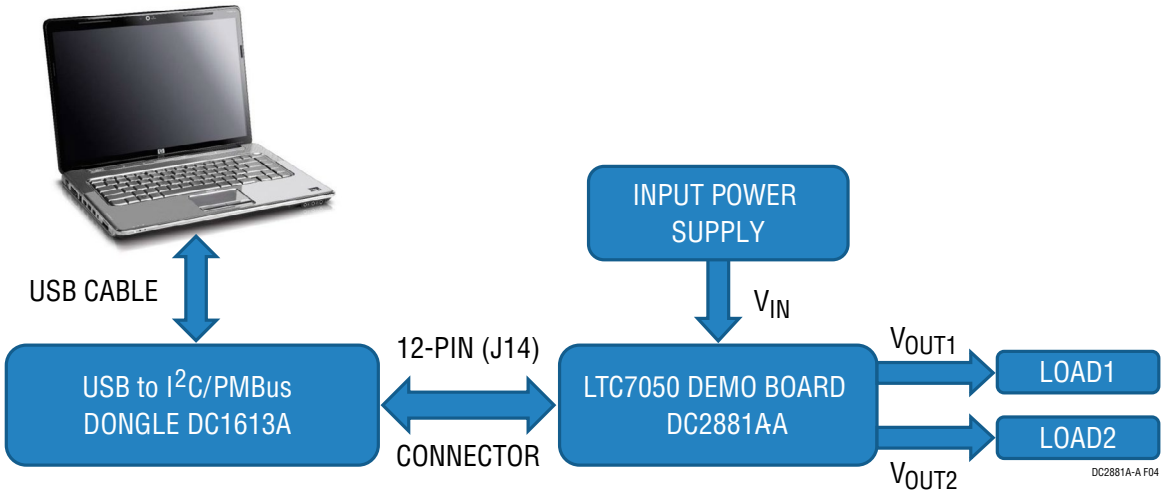


Figure 4. Demo Setup with PC

Efficiency measurement

Headers JP12 – JP16 are kelvin connected close to the power stage for ideal efficiency measurement. For total $V_{OUT1/2}$ rail efficiency, including controller and SPS bias conversion losses, use the setup shown in Figure 5. Check the following setup before measurement:

- JP 20 removed
- Bleeder resistors R85 and R200 removed
- Resistors R196 and R197 removed

To measure the efficiency of LTC7050, refer to the setup in Figure 6. In this setup, the controller, SPS, and IREF biases are provided externally so as to not load the 12V input. Additionally, the SPS bias power loss from the external power source is added to the efficiency calculation as shown below.

$$\eta = \frac{V_{OUT} \bullet I_{OUT}}{V_{IN} \bullet I_{IN} + (V_{DRV} \bullet I_{DRV})}$$

Optionally, FILTERED SW1 (JP12) can be used as the V_{OUT} measurement to obtain efficiency of just the SPS (without inductor losses). JP12 is connected to the switching node of channel 1 through a filter composed of R173 and C26 to obtain the average voltage at the switch node. Check the following setup before measurement:

- JP19 and JP 20 both removed
- JP7 set to OFF
- JP9 set to OFF and JP6 removed
- Bleeder resistors R85 and R200 removed
- Resistors R196 and R197 removed
- R167 and R168 removed
- Apply a 5V power supply between turrets of E35 and E36 for driving power. Measure the voltage and the current for driving power loss.
- Apply a 5V power supply between turrets of E39 and E36 for controller power.
- Apply a 1.5V power supply between turrets of E40 and E41 for I_{REF} voltage.

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

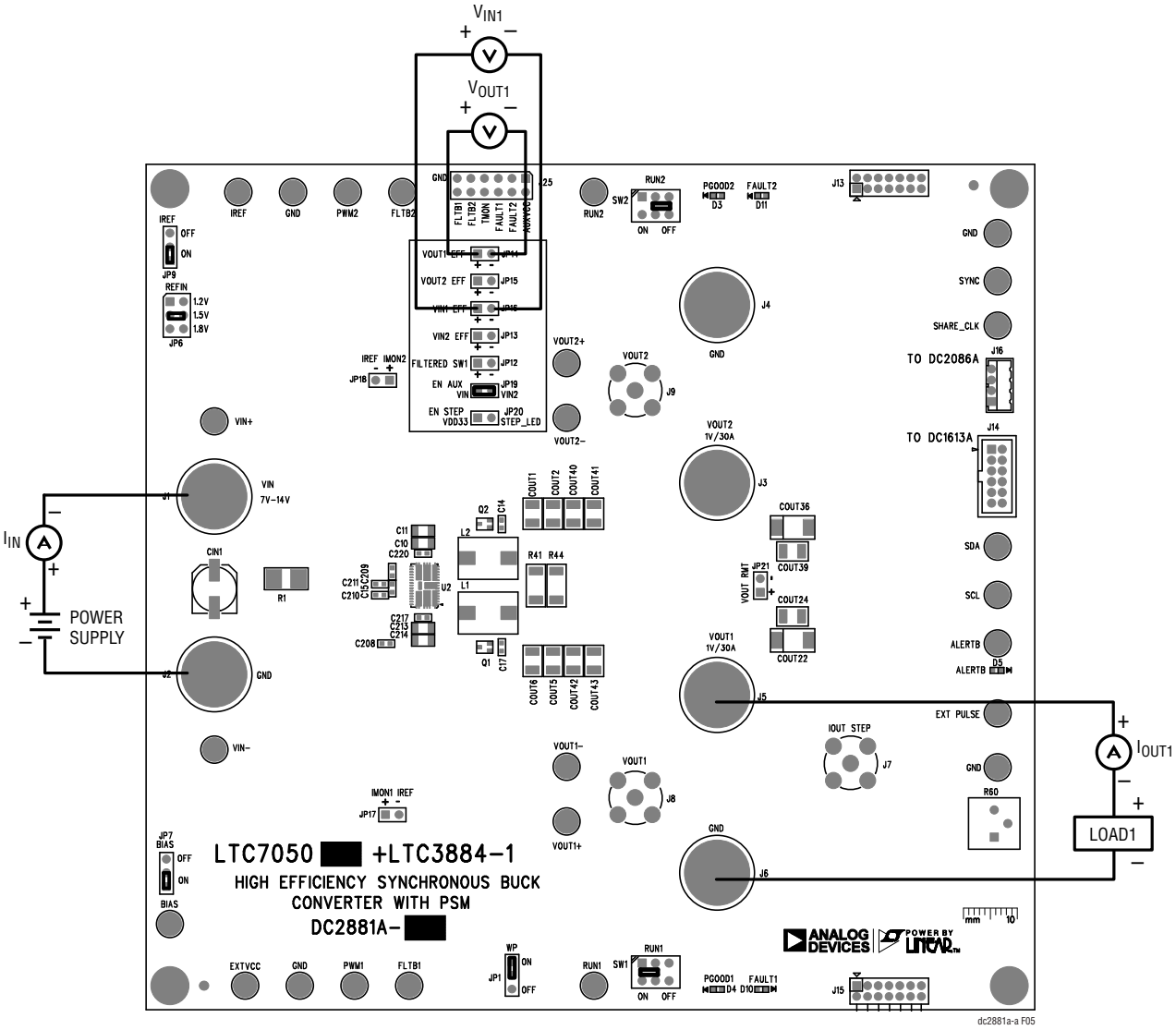


Figure 5. Measuring Setup for DC2881 Efficiency

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

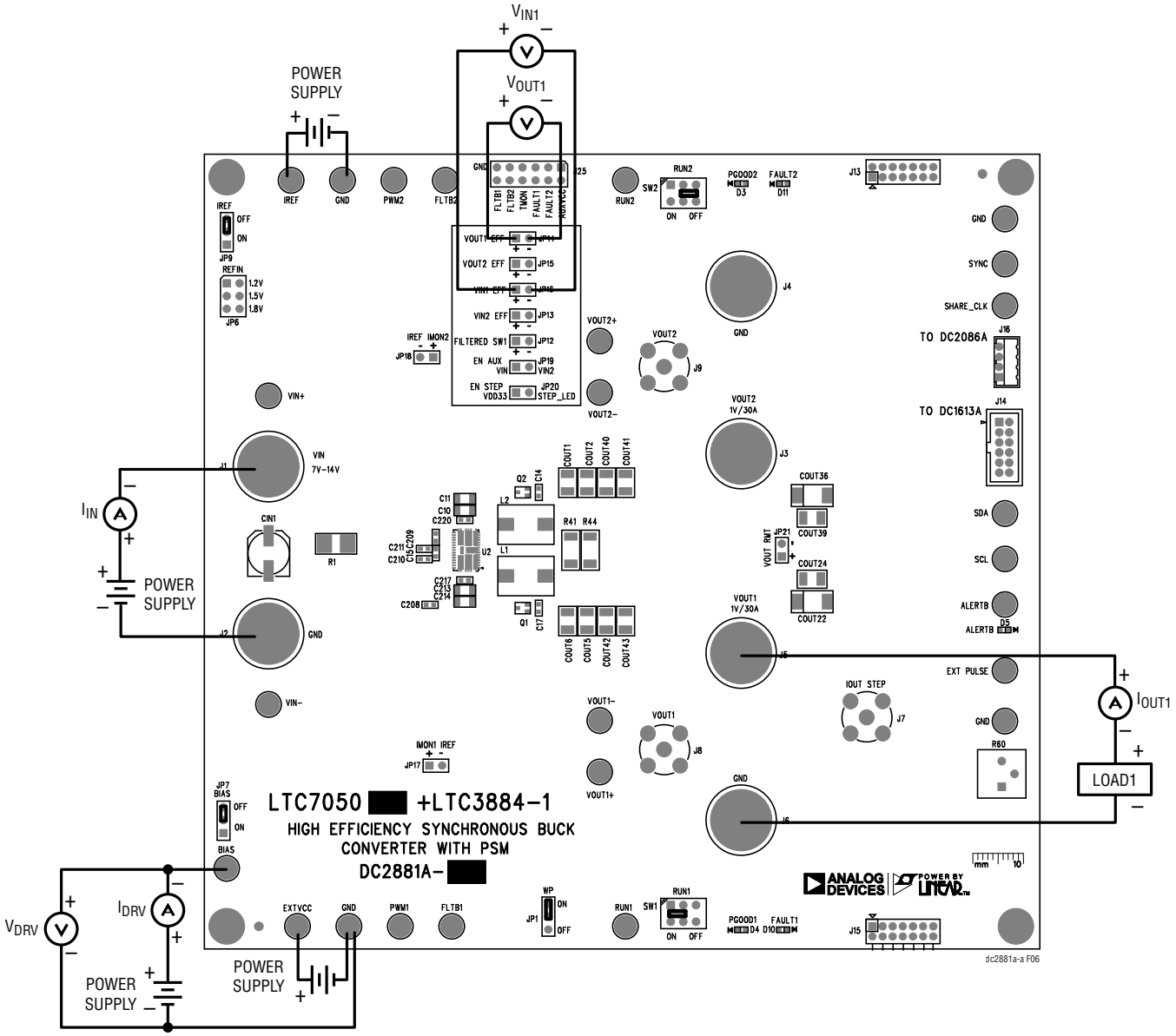


Figure 6. Measuring Setup for LTC7050 Efficiency

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

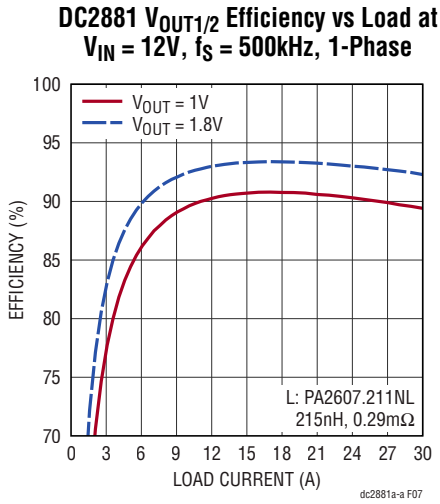


Figure 7. DC2881 Efficiency vs. Load Current on $V_{OUT1/2}$

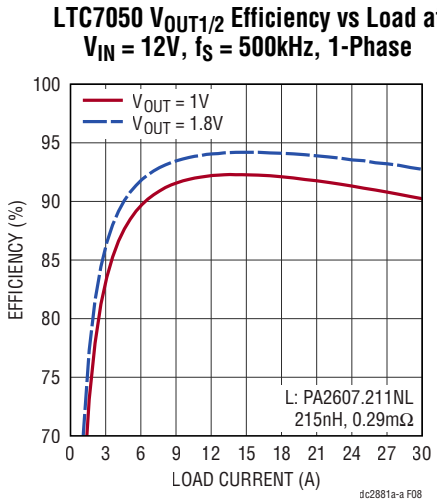


Figure 8. LTC7050 Efficiency vs. Load Current on $V_{OUT1/2}$

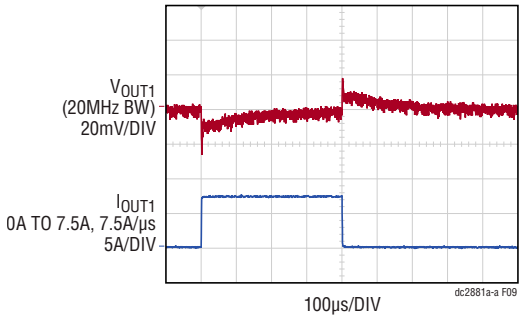


Figure 9. V_{OUT1} Load Transient Response at V_{IN} = 12V, V_{OUT1} = 1V

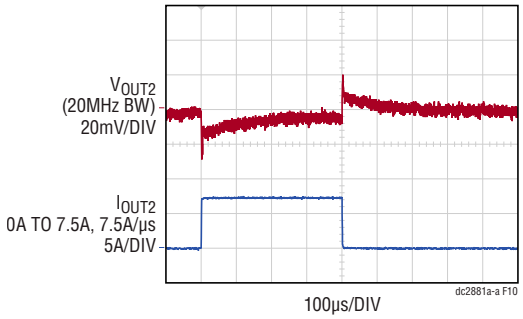


Figure 10. V_{OUT2} Load Transient Response at V_{IN} = 12V, V_{OUT2} = 1V

OUTPUT AND ONBOARD E-LOAD CONFIGURATION

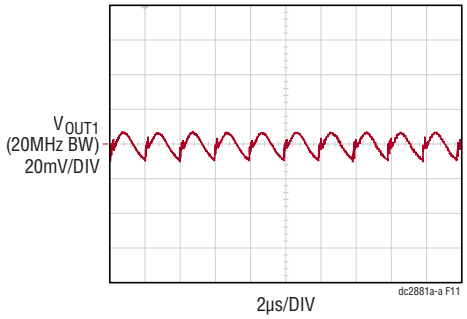


Figure 11. V_{OUT1} Voltage Ripple = 17.4mV at V_{IN} = 12V, V_{OUT1} = 1V, I_{OUT1} = 30A

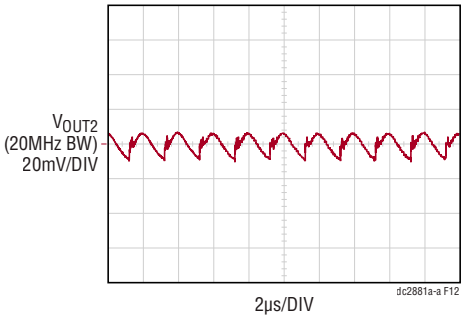


Figure 12. V_{OUT2} Voltage Ripple = 17.4mV at V_{IN} = 12V, V_{OUT2} = 1V, I_{OUT2} = 30A

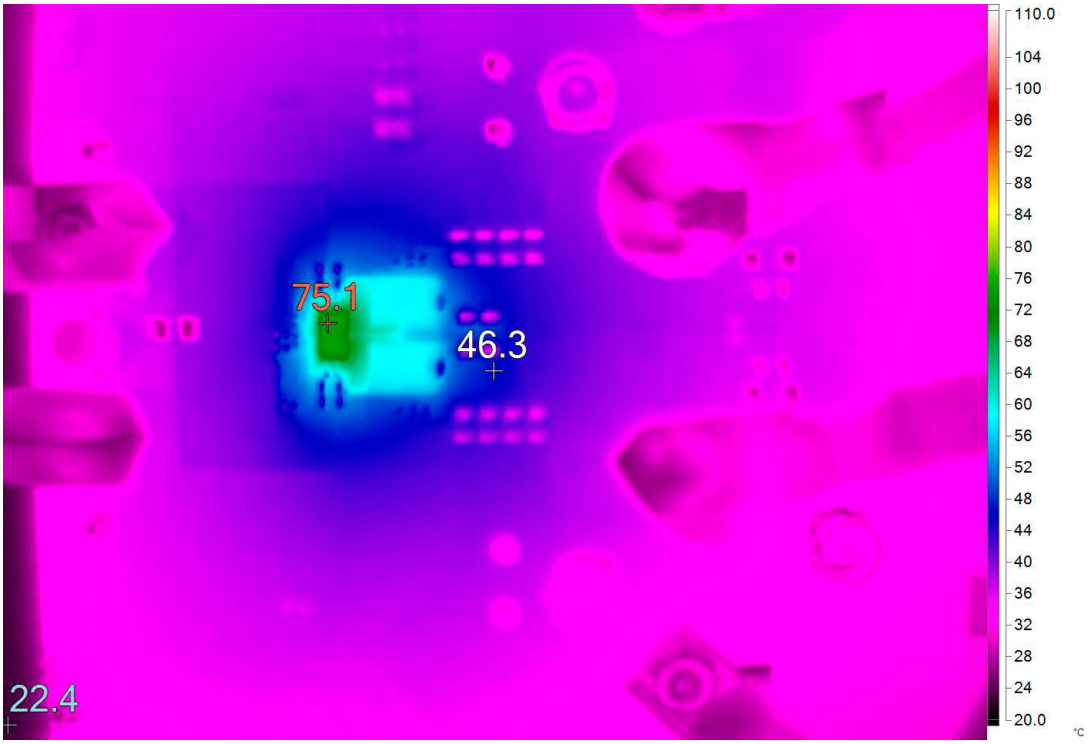


Figure 13. Thermal at V_{IN} = 12V, V_{OUT1} = 1V, I_{OUT1} = 30A, V_{OUT2} = 1V, I_{OUT2} = 30A, T_A = 22°C, No Airflow

LTpowerPlay SOFTWARE GUI

LTpowerPlay is a powerful Windows based development environment that supports Analog Devices power system management ICs and µModules, including LTM4675, LTM4676, LTM4677, LTM4678, LTM4680, LTM4700, LTC3880, LTC3882, LTC3883, LTC3884 and LTC3888-1. 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-I^{2}C/SMBus/PMBus controller to communicate with one of many potential targets, including LTM4675, LTM4676, LTM4677, LTM4678, LTM4680, LTM4700, LTC3880, LTC3882, LTC3883, LTC3884 and LTC3888-1'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 here.

To access technical support documents for ADI's Digital Power System Management Products, visit the LTpowerPlay Help menu.

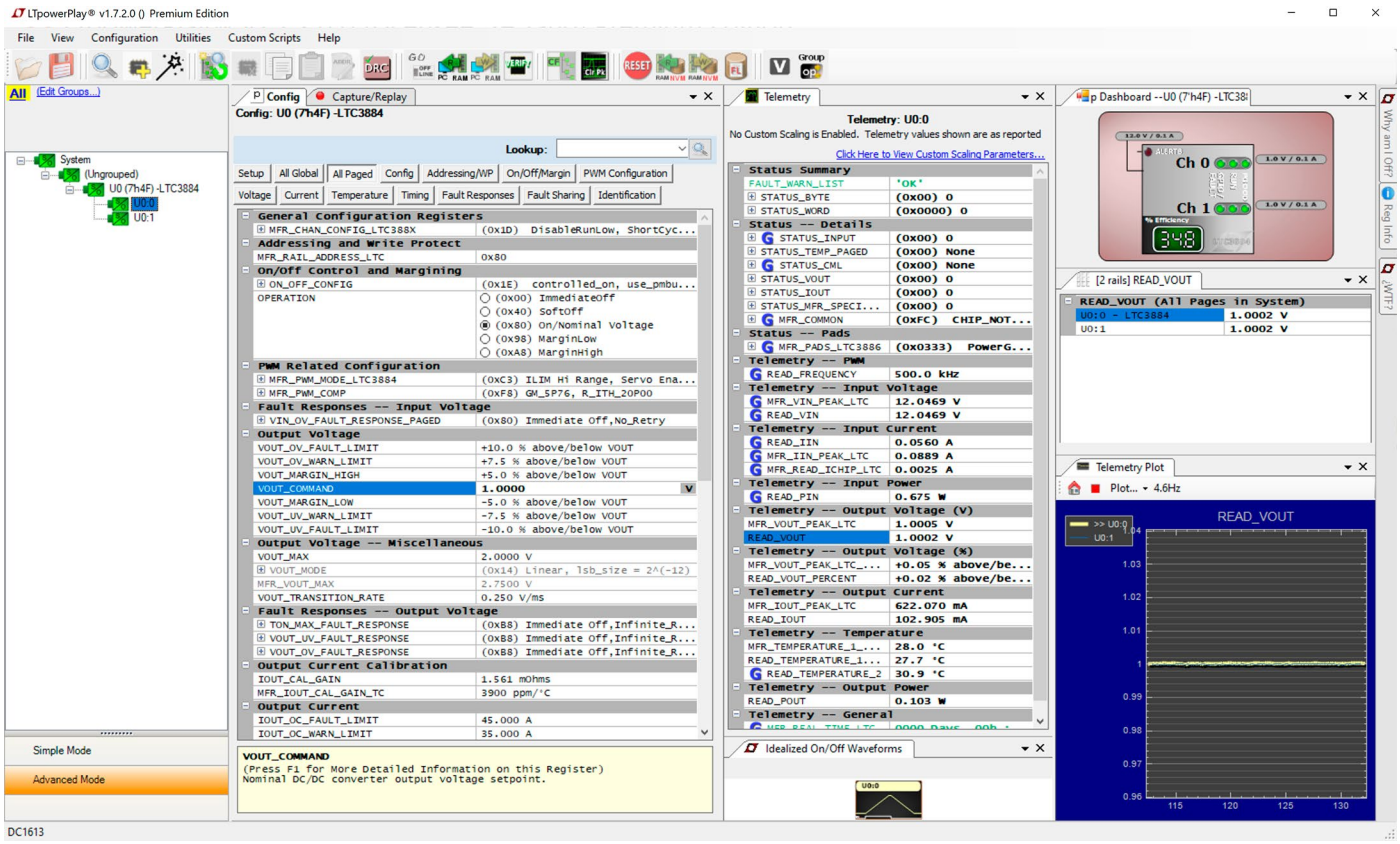


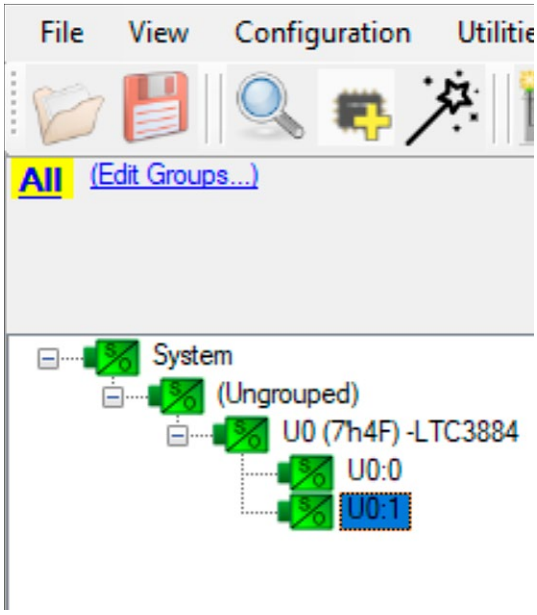
Figure 14. LTpowerPlay Main Interface

LTpowerPlay QUICK START PROCEDURE

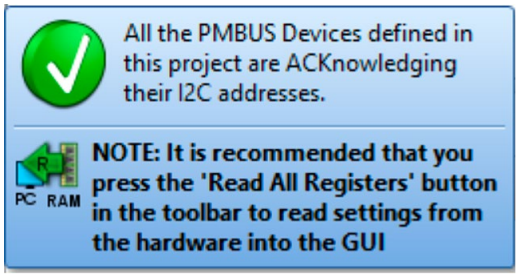
The following procedure describes how to use LTpowerPlay to monitor and change the settings of LTC3884-1.

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

a. The GUI should automatically identify the DC2881A-A. The system tree on the left hand side should look like this:

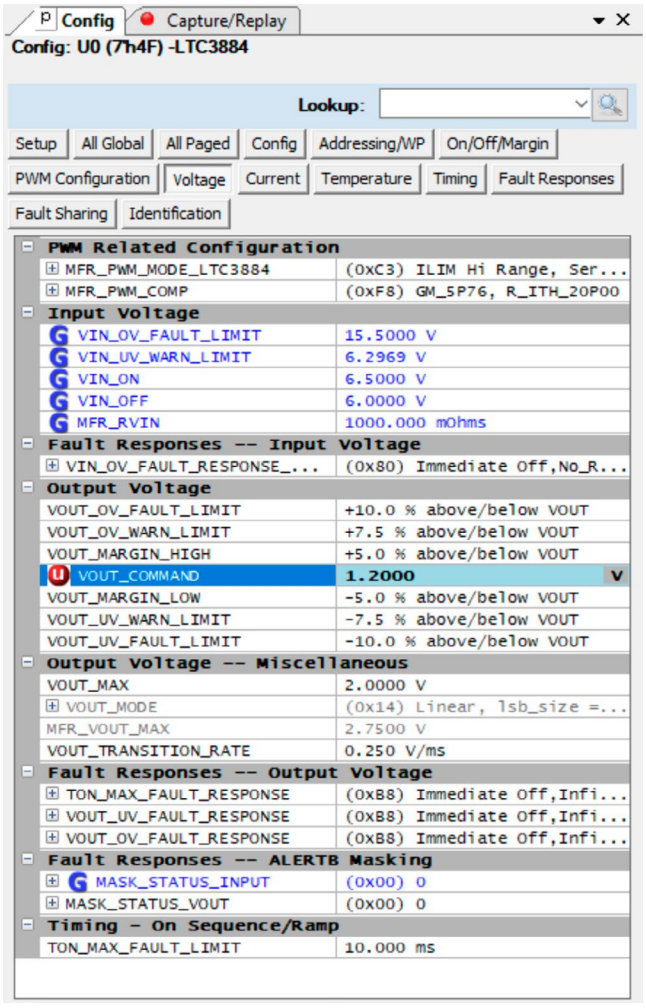


b. A green message box shows for a few seconds in the lower left-hand corner, confirming that LTC3884-1 is communicating:



c. In the Toolbar, click the R (RAM to PC) icon to read the RAM from the LTC3884-1. This reads the configuration from the RAM of LTC3884-1 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 LTC3884-1. After finishing this step, you will see the output voltage will change to 1.2V.

LTpowerPlay QUICK START PROCEDURE

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	3	C1, C3, C186	CAP., 2.2µF, X5R, 25V, 10%, 0603	MURATA, GRM188R61E225KA12D
2	4	C2, C50, C217, C220	CAP., 0.1µF, X7R, 25V, 20%, 0603	AVX, 06033C104MAT2A
3	3	C4, C6, C189	CAP., 4.7µF, X5R, 10V, 10%, 0603	AVX, 0603ZD475KAT2A
4	3	C7, C205, C206	CAP., 1µF, X5R, 6.3V, 20%, 0603	AVX, 06036D105MAT2A
5	10	C8, C10, C11, C212, C213, C214, C215, C216, C218, C219	CAP., 22µF, X7R, 16V, 20%, 1206	TAIYO YUDEN, EMK316BB7226ML-T
6	3	C12, C193, C221	CAP., 100pF, X7R, 25V, 5%, 0603	AVX, 06033C101JAT2A
7	2	C13, C222	CAP., 6800pF, X7R, 50V, 10%, 0603	MURATA, GRM188R71H682KA01D
8	2	C14, C17	CAP., 0.01µF, X7R, 25V, 10%, 0603, AEC-Q200	AVX, 06033C103K4Z2A
9	1	C15	CAP., 1µF, X5R, 16V, 10%, 0603	AVX, 0603YD105KAT2A
10	2	C31, C224	CAP., 10µF, X7R, 25V, 10%, 1210	AVX, 12103C106KAT2A
11	1	C34, C35	CAP., 4.7µF, X5R, 16V, 20%, 1210	AVX, 1210YD475MAT2A
12	2	C48, C194	CAP., 10µF, X7R, 25V, 10%, 1206	AVX, 12063C106KAT2A
13	4	C183, C187, C207, C208	CAP., 47pF, C0G, 50V, 5%, 0603	AVX, 06035A470JAT2A
14	2	C188, C190	CAP., 1µF, X7R, 25V, 10%, 0805, AEC-Q200	TDK, CGA4J3X7R1E105K125AB
15	1	C191	CAP., 5.6pF, C0G/NP0, 50V, ±0.25pF, 0603	AVX, 06035A5R6CAT2A
16	1	C209	CAP., 10µF, X5R, 16V, 10%, 0603	AVX, 0603YD106KAT2A
17	2	C225, C226	CAP., 3300pF, X7R, 50V, 10%, 0603	AVX, 06035C332KAT2A
18	2	CIN1, CIN2	CAP., 270µF, ALUM, 16V, 20%, SMD 8 × 11.9mm, E12	PANASONIC, 16SVPC270M
19	8	COUT1, COUT2, COUT5, COUT6, COUT40, COUT41, COUT42, COUT43	CAP., 47µF, X7R, 6.3V, 10%, 1210, AEC-Q200, NO SUBS ALLOWED	MURATA, GCM32ER70J476KE19L
20	4	COUT3, COUT4, COUT7, COUT8	CAP., 470µF, TANT, POSCAP, 2.5V, 20%, 7343, TPF SERIES	PANASONIC, ETPF470M5H
21	2	L1, L2	IND., 215nH, PWR, FERRITE, 10%, 61A, 0.29mΩ, 10.4 × 8.0mm SMD	PULSE, PA2607.211NL
22	1	L4	IND., 4.7µH, PWR, 20%, 5.9A, 40mΩ, 5.48 × 5.28mm SMD, XAL5030, AEC-Q200	COILCRAFT, XAL5030-472MEB
23	2	Q1, Q2	XSTR., PNP, 40V, 0.2A, SOT-323, AEC-Q101	DIODES INC., MMST3906-7-F

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
24	2	Q7, Q8	XSTR., MOSFET, N-CH, 60V, 220mA, SOT23-3, AEC-Q101	DIODES INC., 2N7002A-13
25	1	Q9	XSTR., MOSFET, N-CH, 30V, 90A, TO-252-3 (DPAK)	INFINEON, IPD90N03S4L-02
26	1	R1	RES., 0.001Ω, 1%, 1W, 2512, METAL, SENSE, AEC-Q200	VISHAY, WSL25121L000FEA
27	2	R2, R183	RES., 1Ω, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F1R00TRF
28	17	R3, R4, R5, R16, R167, R171, R172, R177, R179, R184, R186, R190, R191, R194, R195, R222, R223	RES., 0Ω, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
29	12	R6, R8, R10, R29, R30, R34, R181, R182, R185, R187, R192, R193	RES., 10k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF1002V
30	1	R9	RES., 4.99k, 1%, 1/10W, 0603	PANASONIC, ERJ3EKF4991V
31	3	R11, R12, R13	RES., 1k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06031K00FKEA
32	1	R82	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
33	1	R83	RES., 1.24M, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06031M24FKEA
34	1	R84	RES., 402Ω, 1%, 1/4W, 1206, AEC-Q200	VISHAY, CRCW1206402RFKEA
35	2	R85, R200	RES., 27.4Ω, 1%, 1W, 2512, AEC-Q200	PANASONIC, ERJ1TNF27R4U
36	1	R160	RES., 2Ω, 1%, 1/10W, 0603	VISHAY, CRCW06032R00FNEA
37	2	R161, R170	RES., 43.2k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF4322V
38	1	R162	RES., 60.4k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060360K4FKEA
39	1	R164	RES., 200k, 1%, 1/10W, 0603	NIC, NRC06F2003TRF
40	1	R166	RES., 84.5k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F8452TRF
41	1	R168	RES., 1Ω, 5%, 1/4W, 1206, AEC-Q200	PANASONIC, ERJ8GEYJ1R0V
42	3	R169, R208, R209	RES., 619k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F6193TRF
43	1	R206	RES., 0Ω, 1/8W, 0805	VISHAY, CRCW08050000Z0EA
44	1	R207	RES., 931k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF9313V
45	2	R224, R225	RES., 150Ω, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF1500V
46	1	U1	IC, STEP-DOWN POWER CONTROLLER, GQFN-48	ANALOG DEVICES INC., LTC3884IRHE-1#PBF
47	1	U2	IC, DUAL MONOLITHIC DRIVER AND HALF BRIDGE, LQFN-42	ANALOG DEVICES INC., LTC7050AV#PBF
48	1	U8	40V, 1A, 100µA I_Q SYNCHRONOUS STEP-DOWN CONVERTER, MSE-16	ANALOG DEVICES INC., LTC3646EMSE-1#PBF
49	1	U9	IC, 3µA I_Q, 20mA, 45V LOW, DROP OUT LINEAR REGULATOR, SOT-8	ANALOG DEVICES INC., LT3008ETS8#PBF

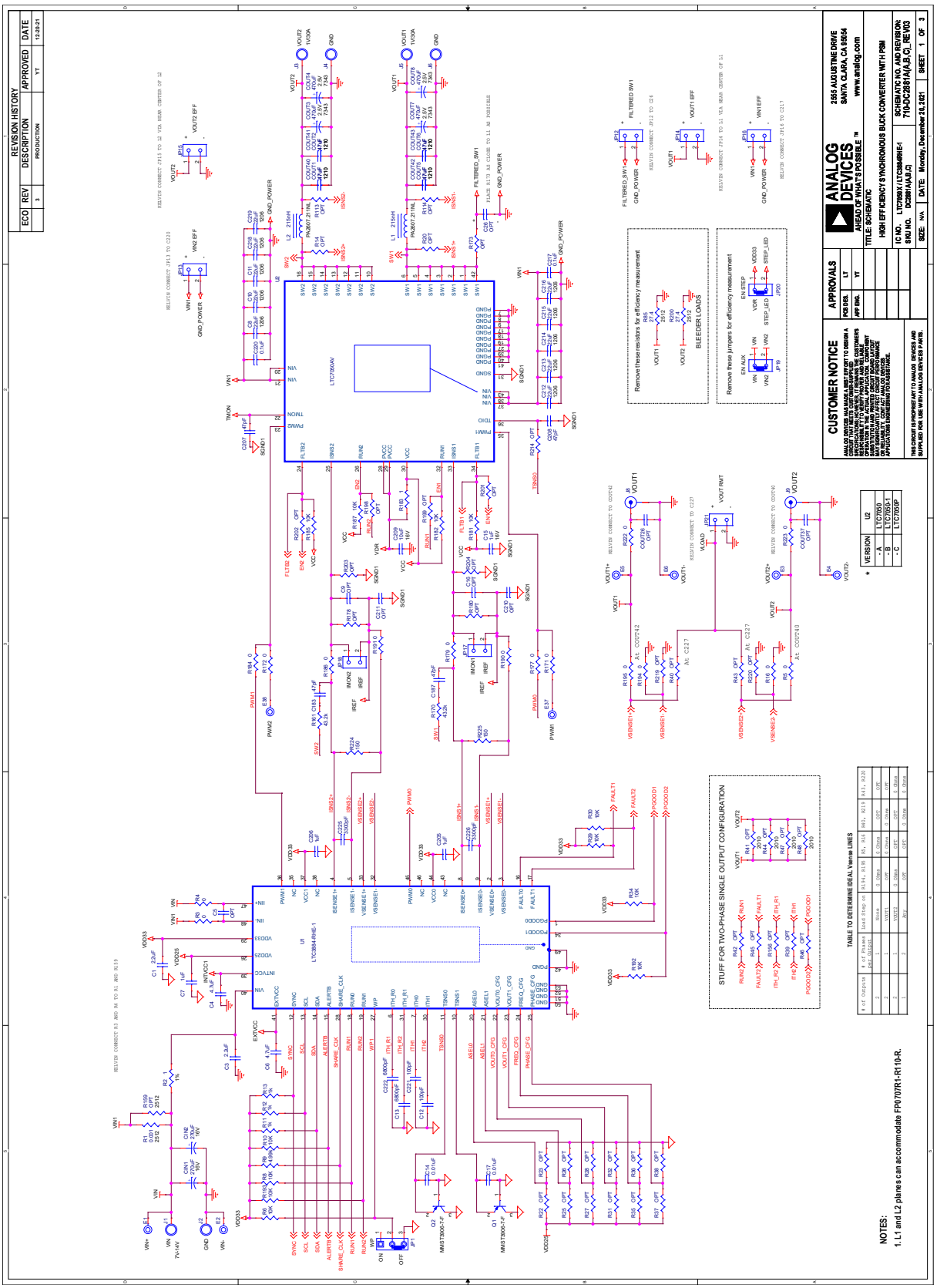
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Additional Demo Board Circuit Components				
1	0	C5, C9, C16, C26, C192, C210, C211, COUT26, COUT37	CAP., OPTION, 0603	
2	2	C27, C28	CAP., 0.01µF, X7R, 25V, 10%, 0603, AEC-Q200	AVX, 06033C103K4Z2A
3	2	C34, C35	CAP., 4.7µF, X5R, 16V, 20%, 1210	AVX, 1210YD475MAT2A
4	2	C39, C50	CAP., 0.1µF, X7R, 25V, 20%, 0603	AVX, 06033C104MAT2A
5	2	C40, C42	CAP., 10pF, X7R, 10V, 10%, 0603	AVX, 0603ZC100KAT2A
6	1	C41	CAP., 1µF, X5R, 16V, 10%, 0603	AVX, 0603YD105KAT2A
7	0	COUT22, COUT36	CAP., OPTION, 7343	
8	2	COUT23, COUT35	CAP., 470µF, TANT, POSCAP, 2.5V, 20%, 7343, TPF Series	PANASONIC, ETPF470M5H
9	4	COUT24, COUT25, COUT38, COUT39	CAP., 100µF, X5R, 6.3V, 20%, 1210	AVX, 12106D107MAT2A
10	1	C227	CAP., 22µF, X7R, 16V, 20%, 1210, AEC-Q200	MURATA, GCM32ER71C226ME19L
11	0	D6, D7	DIODE, OPTION, SOD-323	
12	2	D3, D4	LED, GREEN, WATER CLEAR, 0603	WURTH ELEKTRONIK, 150060GS75000
13	3	D5, D10, D11	LED, RED, WATER CLEAR, 0603	WURTH ELEKTRONIK, 150060RS75000
14	1	D8	DIODE, SCHOTTKY, 20V, 0.5A, SOD-882, LEADLESS	NEXPERIA, PMEG2005AEL, 315
15	0	D9	DIODE, OPTION, SCHOTTKY, POWERDI 123	
16	0	R14, R20, R22, R23, R25, R26, R27, R28, R31, R32, R35, R36, R37, R38, R39, R40, R42, R43, R45, R46, R113, R114, R120, R121, R122, R126, R133, R136, R138, R142, R145, R151, R156, R173, R178, R180, R198, R199, R201, R202, R203, R204, R214, R215, R216, R217, R218, R219, R220	RES., OPTION, 0603	
17	3	R69, R70, R82	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
18	0	R41, R44, R47, R48, R196	RES., OPTION, 2010	
19	6	R59, R127, R137, R147, R205, R221	RES., 0Ω, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
20	1	R60	RES., 5k, 10%, 1/2W, THT 3/8" SQ, 1-TURN, TOP ADJ., TRIMPOT	BOURNS, 3386P-1-502LF
21	1	R61	RES., 154k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F1543TRF
22	3	R62, R125, R130	RES., 20k, 1%, 1/10W, 0603	NIC, NRC06F2002TRF
23	1	R64	RES., 1M, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F1004TRF
24	1	R65	RES., 681k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F6813TRF
25	1	R66	RES., 18k, 5%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060318K0JNEA
26	2	R67, R211	RES., 2k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06032K00FKEA
27	1	R68	RES., 3.3Ω, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06033R30FKEA
28	5	R72, R79, R81, R123, R212	RES., 10k, 1%, 1/10W, 0603, AEC-Q200	PANASONIC, ERJ3EKF1002V

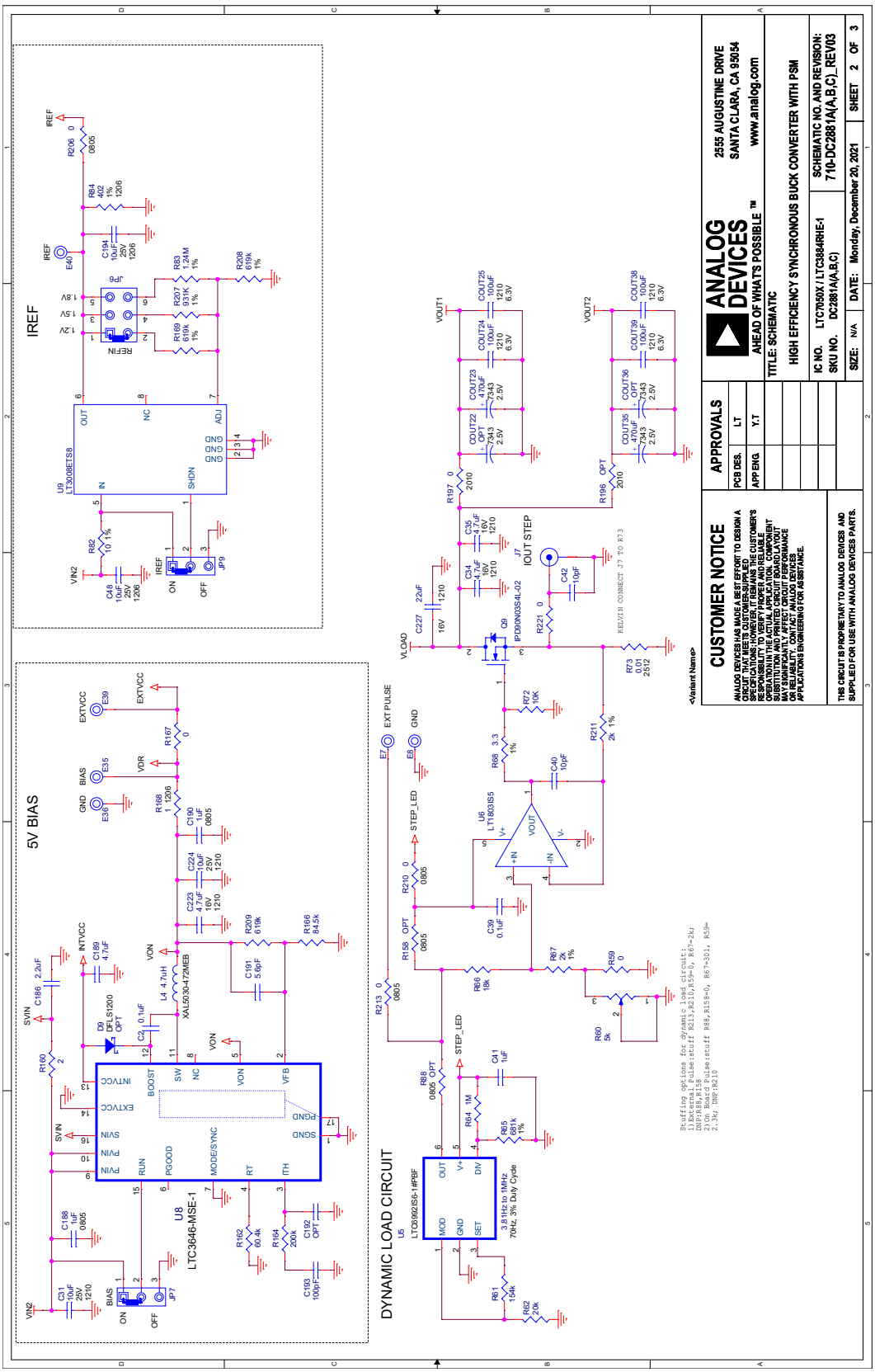
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
29	1	R73	RES., 0.01Ω, 1%, 1W, 2512, PWR, METAL, SENSE, AEC-Q200	VISHAY, WSL2512R0100FEA
30	0	R88, R158	RES., OPTION, 0805	
31	2	R69, R70	RES., 10Ω, 1%, 1/10W, 0603	VISHAY, CRCW060310R0FKEA
32	2	R128, R150	RES., 4.99k, 1%, 1/10W, 0603	PANASONIC, ERJ3EKF4991V
33	0	R139	RES., OPTION, 1206	
34	1	R144	RES., 15.8k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F1582TRF
35	0	R159	RES., OPTION, 2512	
36	1	R197	RES., 0Ω, JUMPER, 75A, 2010, COPPER, SENSE	VISHAY, WSL201000000ZEA9
37	2	R210, R213	RES., 0Ω, 1/8W, 0805	VISHAY, CRCW08050000Z0EA
38	4	Q3, Q4, Q21, Q22	XSTR., MOSFET, P-CH, 30V, 3.3A, SOT-23-3	DIODES INC., DMP3068L-13
39	1	U3	IC, EEPROM, I^2C, TSSOP-8, 2Kb (256 × 8), 400kHz	MICROCHIP, 24LC024-I/ST
40	1	U5	OSC., 3.81Hz to 1MHz, 5pF, 90ppm, TSOT23-6	ANALOG DEVICES INC., LTC6992IS6-1#PBF
41	1	U6	IC, SINGLE R to R IN/OUT OP AMP, TSOT23-5, 100V/µs, 85MHz	ANALOG DEVICES INC., LT1803IS5#PBF
Hardware: For Demo Board Only				
1	25	E1, E2, E3, E4, E5, E6, E7, E8, E10, E11, E12, E13, E14, E16, E19, E20, E33, E34, E35, E36, E37, E38, E39, E40, E41	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
2	6	J1, J2, J3, J4, J5, J6	EVAL BOARD STUD HARDWARE SET, #10-32	ANALOG DEVICES INC., 720-0010
3	3	J7, J8, J9	CONN., RF, BNC, RCPT, JACK, 5-PIN, ST, THT, 50Ω	AMPHENOL RF, 112404
4	1	J13	CONN., HDR, FEMALE, 2 × 7, 2mm, R/A THT	SULLINS CONNECTOR SOLUTIONS, NPPN072FJFN-RC
5	1	J14	CONN., HDR, SHROUDED, MALE, 2 × 6, 2mm, VERT, ST, THT	AMPHENOL, 98414-G06-12ULF
6	1	J15	CONN., HDR, MALE, 2 × 7, 2mm, R/A THT	MOLEX, 0877601416
7	1	J16	CONN., HDR, SHROUDED, MALE, 1 × 4, 2mm, VERT, ST, THT	HIROSE ELECTRIC, DF3A-4P-2DSA
8	1	J25	CONN., HDR, MALE, 2 × 6, 2.54mm, VERT, ST, THT, 30u" Au	SAMTEC, TSW-106-07-S-D
9	3	JP1, JP7, JP9	CONN., HDR, MALE, 1 × 3, 2.54mm, VERT, ST, THT	SAMTEC, TSW-103-07-L-S
10	1	JP6	CONN., HDR, MALE, 2 × 3, 2.54mm, VERT, ST, THT	SAMTEC, TSW-103-07-L-D
11	8	JP12, JP13, JP14, JP15, JP16, JP19, JP20, JP21	CONN., HDR, MALE, 1 × 2, 2.54mm, VERT, ST, THT	WURTH ELEKTRONIK, 61300211121
12	2	JP17, JP18	CONN., HEADER, HDR, 2 POS, 2.54mm, ST THT	SAMTEC, TSW-102-06-L-S
13	4	MP25, MP26, MP27, MP28	STANDOFF, NYLON, SNAP-ON, 0.625 (5/8"), 15.9mm	KEYSTONE, 8834
14	2	SW1, SW2	SWITCH, SLIDE, DPDT, 0.3A, 6VDC, PTH	C&K, JS202011CQN
15	6	XJP1, XJP6, XJP7, XJP9, XJP19, XJP20	CONN., SHUNT, FEMALE, 2 POS, 2.54mm	SAMTEC, SNT-100-BK-G

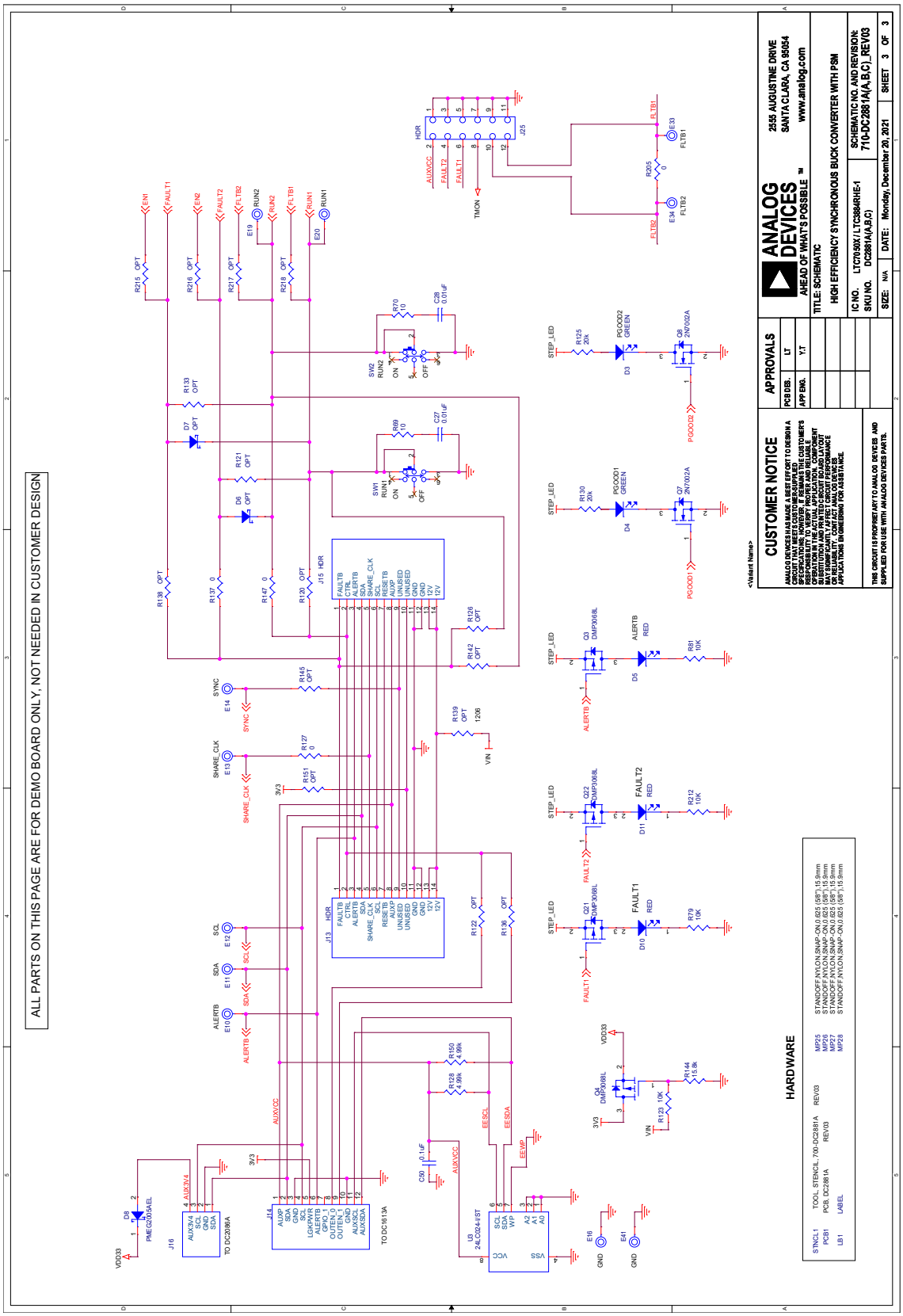
SCHEMATIC DIAGRAM



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.