DEMO CIRCUIT 1262A&B
QUICK START GUIDE

LTC2970 DUAL POWER SUPPLY MONITOR AND MARGIN CONTROLLER

DESCRIPTION

Demonstration circuit DC1262A&B features the LTC2970CUFD running in conjunction with a low cost microcontroller to form a complete dual power supply monitoring and margining solution. The microcontroller and its code demonstrate the ability of the LTC2970 + Microcontroller to perform the following functions:

- Continuously trim and hold an output voltage to extreme accuracy over time and temperature.
- MARGIN HI, MARGIN LOW, NO MARGIN with a tri-state switch.
- ENABLE, DISABLE via a SPST switch
- Sequence two power supplies up (on) and down (off) with variable delay between them.
- Shut off outputs or shut off then retry in response to any one of 19 user settable faults

All of the operating parameters and fault limits can be selected in a PC based GUI and loaded into the operating memory or EEPROM of the microcontroller. The board can then be unplugged and will autonomously control two power supplies. A green LED indicates that the power supply is either operating within spec or faulted off. In the event of a fault, the microcontroller can either shut down the power supplies immediately or enter a retry sequence. This is GUI selectable. A series of LED blink codes uniquely identifies which type of fault occurred.

The DC1262B is the companion board to the DC1262A. It contains the LTC3828 dual output, 2-phase synchronous buck regulator capable of 5V @5A and 3.3V@5A. The LTC3828 allows tracking between outputs.

The microcontroller is an Atmel 8 bit ATtiny85. It comes pre-programmed with all code necessary to perform the above functions. Its EEPROM is loaded with factory default settings for all of the fault limits such as OV, UV, OC and Overtemp appropriate for the output voltages of the DC1262B. A typical customer application will be able to use the more economical ATtiny25 or 45 since much of the code space in memory is consumed by running the demo.

The DC1262A Demo GUI provides the user with an intuitive interface from which he can reconfigure all of the default settings of the LTC2970. It receives telemetry data from the microcontroller and provides marching waveform representations of the output voltages and temperature.

The DC1262A&B demo circuit may also be controlled and exercised with LTC's QuickEval software from a PC.

Design files for this circuit board are available. Call the LTC factory.

LTC2970 PERFORMANCE SUMMARY **Specifications over temp -40°C ≤ T_A ≤85°C**

PARAMETER	CONDITIONS	VALUE
12V_{IN} Supply Input Voltage Range		7V-15V
V_{DD} Supply Input Voltage Range		4.5V-5.75V
ADC Full-Scale Accuracy		0.4%
ADC Total Unadjusted Error	V_{IN}=3V	0.5%
ADC Input Range		0V-6V

LTC2970 PERFORMANCE SUMMARY **Specifications over temp -40°C ≤ T_A ≤85°C**

PARAMETER	CONDITIONS	VALUE
ADC Resolution	Resolution = 8.192V/16384	500 V/LSB
ADC Conversion Rate		30Hz
Margining DAC Resolution		8 bits
Temperature Sensor Resolution		0.25 C/LSB
I^2C Serial Clock Frequency		10kHz-400 kHz

OPERATING MODES

You can operate the DC1262A&B Demo System in 3 different modes. (1) Autonomous mode (no PC required) or it can be run interactively from the (2) DC1262A Demo GUI or it can be run from the (3) LTC QuickEval GUI. The DC1262A can be used alone to control external power supplies. The best approach is to start from DC1262A Demo GUI mode, program the operating parameters and limits, shut down the GUI then unplug the ribbon cable from the DC1262A and run in autonomous mode.

QUICK START PROCEDURE

The following procedure describes how to set up DC590B, DC1262A and the DC1262B companion board in order to evaluate the performance of the LTC2970IUFD. Demo kits DC590B and DC1262A&B are required.

1. Obtain a copy of the DC1262A Demo GUI install software from your LTC Field Applications Engineer. (Available on the LTC FAE Intranet). Run the install program. The software automatically loads the Microsoft .NET framework on your PC if you don't have it. It also loads LTC's QuickEval demo software if you don't already have it and places shortcuts on your desktop.
2. Make sure no power is applied to the setup. Connect the DC1262A and DC1262B cards together using the 20 pin edge connector. Configure the jumpers as described in Tables 1 and 2 below.
3. Make sure JP6 on DC590B is in the middle position (5V).
4. Set the DC1262A ENABLE switch to OFF and the MARGIN switch to NO MARGIN.
5. Launch the DC1262A Demo GUI. It will guide you the rest of the way through the installation porocess.
6. Connect and setup your loads to the DC1262B board. Observe the ratings. Start at light or no load.
7. Plug the DC jack of the 12V wall mount power supply into J1 of the DC1262B board. Plug the power supply into an AC outlet.
8. Throw the enable switch on DC1262A to on. The status LED should glow constant green.
9. Proceed to evaluation procedure #1 described below.

Table 2. The default locations of DC1262A's configuration jumpers are as follows:

JP1 GPIO_CFG	JP2 ASEL0	JP3 ASEL1	JP5 DAC1 TERMINATION	JP6 DAC0 TERMINATION	JP7 WRITE- PROTECT	
HI	HI	HI	IOUT1	IOUT0	ON	

Table 3. The default locations of DC1262B's configuration jumpers are as follows:

JP1 PHSMD	JP2 FSET	JP3 FCB	JP4 RUN1	JP5 RUN2	JP6 TRACK2	JP7 TRACK1
0	550kHz	CCM	ON	ON	EXT1	VOUT1

SPECIFICATIONS

Blink Codes: The green power good LED

ALERTB faults	Starts with a series of rapid flashes then long blinks	Number of long blinks
	Ch0_a_overvoltage	1 blink
	Ch0_a_undervoltage	2 blinks
	Ch0_b_ overcurrent	4 blinks
	Ch1_a_ overvoltage	6 blinks
	Ch1_a_ undervoltage	7 blinks
	Ch1_b_ overcurrent	9 blinks
	Vdd_ overvoltage	11 blinks
	Vdd_ undervoltage	12 blinks
	V12_ overvoltage	13 blinks
	V12_ undervoltage	14 blinks
Other faults	LONG BLINKS-NO FLASH	
	Overtemp	2 blinks
	PGOOD fault	3 blinks
	I2C or Initialization fail	4 blinks
	General fail	5 blinks
	Telemetry stuck	6 blinks
ALERTB RED LED	Idac fault (Idac fails to connect)	Short flashes

SPECIFICATIONS – DC1262A&B

PARAMETER	CONDITIONS	VALUE (default)
Sequencing range	Chan 1 lags chan 0	0 to 3.277sec
Ton0delay/Toff1delay step size	Delay from enable switch	50us
Sequencing step size		200 us
Power up delay Ch0-Ch1	Default	500ms
Power down delay Ch0-Ch1	Default	500ms
Fault retry interval	From fault off to re-enable	6 sec
Overtemp shutoff	Default	35C
Overtemp retry	Default	30C
Max 5V programmable voltage	With default R's	5.96V
Min 5V programmable voltage	With default R's	4.0V
Max 3.3V programmable voltage	With default R's	3.96V
Min 3.3V programmable voltage	With default R's	2.66V

EVAL PROCEDURES: GENERAL INFO

1. The voltage and currents may be viewed on the “Telemetry and Status” tab of the GUI or with lab equipment.
2. When using the DC1262B, plug the12V Wall Adapter power into its jack. The DC jack on the DC1262A is only used when the DC1262A alone is controlling an external power supply and no DC1262B is present.
3. The units for time delays may be entered into the GUI using: u=microseconds, s=seconds, ms=milliseconds

NOTE: Prior to unplugging the DC1262A&B to run in autonomous mode, be sure to:
1) exit the GUI.
2) unplug the ribbon cable.
Prior to running QuickEval, exit the DC1262A Demo GUI.

STARTING DEMO GUI MODE

1. Make sure no power is applied to the setup. Connect the DC1262A and DC1262B cards together using the 20 pin edge connector.
2. Connect DC590B to PC with USB. Plug DC590B to DC1262A with ribbon cable.
3. Hook up whatever instruments such as scopes and meters and loads to the turrets you wish to monitor.
4. Launch DC1262A Demo GUI. It will automatically update itself if needed. It will offer the option to update the firmware in the microcontroller if a new release is available.
5. Apply power to the DC jack. Turn on ENABLE switch. Voltages should come up to 5V and 3.3V.
6. Waveforms are viewed on the “Telemetry and Status” tab. It is best to make the desired changes then go to the Telemetry tab then click on “Write Operating Memory” to see the changes take effect.
7. If you disconnect the ribbon cable from DC1262A then reconnect, the GUI will read the values in operating memory. At first power on, the operating memory and the GUI are loaded with the values stored in the NV Memory of the microcontroller.

EVAL PROCEDURE #1: TRIM ONCE VS CONTINUOUSLY

1. Go to the Telemetry tab. Read the pop up guide. Try zoom, pan and other features.
2. Go back to the Output Configuration tab and check, “trim continuously” then return to Telemetry tab.
3. Check “Write Operating Memory”. Zoom in and out on the waveform.

EVAL PROCEDURE #2: SEQUENCING

1. Start in Demo GUI mode.
2. Turn the power supply on and off with the ENABLE switch. Note the delay between Ch0 and Ch1.
3. On the Sequencing tab, change the values of turn on and turn off delay. Observe.
4. Note that Channel 1 always lags during startup and leads during shutdown.

EVAL PROCEDURE #3: MARGINING

1. Start in Demo GUI mode.

2. In the “Output Configuration tab, set the desired margin values.
3. Turn on Enable switch.
4. Using the MARGIN switch, margin high, margin low.

EVAL PROCEDURE #4: MARGIN INTO OVERVOLTAGE/UNDERVOLTAGE FAULT

1. On the Fault configuration tab, about ½ way down, check the “retry” button.
2. On Output Configuration Tab, set the Ch 0 OV fault limit to 5.25V. Set the Ch 0 margin high level to 5.5V.
3. Set the ch 1 margin low level to 3.0V. Set the UV fault level to 3.25V.
4. Click “Auto Write Changes” below the Write Operating Memory box.
5. Margin high and low. Watch the power supplies fault off and retry. Watch the faults light up on the telemetry screen.
6. Check the shutdown box on the Fault Config tab. Margining will now make it fault off and stay off.

EVAL PROCEDURE #5: OVERVOLTAGE AND SHUTDOWN

1. ON any screen, reset to default values by clicking Read NVRAM.
2. On the Fault Config tab, under fault action, check the “shutdown” radio button. Write Operating Memory.
3. Using a jumper wire, short the VOUT0 turret to GND. Observe the 5V go OV and shutdown. Observe the LED blink code and the fault status on the telemetry page of the GUI.
4. Cycle the enable switch to restart.

EVAL PROCEDURE #6: OVERCURRENT FAULTS

1. On the Output configuration tab, check “auto write changes”.
2. On the Fault configuration tab, under fault action, check the retry radio button.
3. With a jumper, short circuit either output of the DC1262B from the output turret to the adjacent GND turret.
4. Observe blink codes. During the 1st retry interval, you may see either a PGOOD or UV fault. Verify that the power supply retries. Remove jumper. Verify restart.
5. An overcurrent condition may also be induced with external loads.

EVAL PROCEDURE #7: OVERTEMPERATURE

1. On the Telemetry tab, note the temp reading in the lower left corner, at ambient, T= 2x.xx.
2. On the Output configuration tab, set the fault limit to a temp you can reach with a heat source and the retry level to something above the temp reading from step 1.
3. Apply heat to the 2970. Observe the shutdown and restart.

EVAL PROCEDURE #8: AUTONOMOUS OPERATION

1. On the Output configuration tab, change the voltages as desired.
2. Set the Ch 0 OV fault limit to 5.25V. Set the Ch 0 margin high level to 5.5V.
3. On the “Fault configuration tab”, set Fault Action to Retry.

4. Write the changes to operating memory.
5. Kill the GUI.
6. Unplug the 14 pin ribbon cable from the DC1262A. The power supply will now retain the settings.
7. Toggle the switch to margin high. Notice blink code indicating a Ch0 OV. Return the switch to no margin and notice the power supply recover.
8. With a jumper, short one of the outputs. Observe the blink codes. The first 2 blink codes may be the PGOOD fault code. Subsequent codes will indicate a short. Remove jumper and watch it recover.
9. Using a jumper wire, momentarily short the VOUT1 turret to GND. Observe the blink code = 6.
10. Return to demo GUI mode.
    a. Shut off ENABLE switch.
    b. Launch demo GUI
    c. Re-plug in the 14 pin ribbon able.
    d. Turn on ENABLE switch.
    e. On the Output Configuration Tab, Click “Read NVRAM” to restore factory defualts.

QUICKEVAL™ MODE OPERATION

1. Kill the 1262A demo GUI if running.
2. Launch QuickEval and run as described in DC980A&B Quickstart guide.
3. NOTE: The green LED will go out and the switches will have no effect in this mode. QuickEval is controlling the LTC2970.
4. NOTE: Be sure to exit QuickEval before you go to other modes.

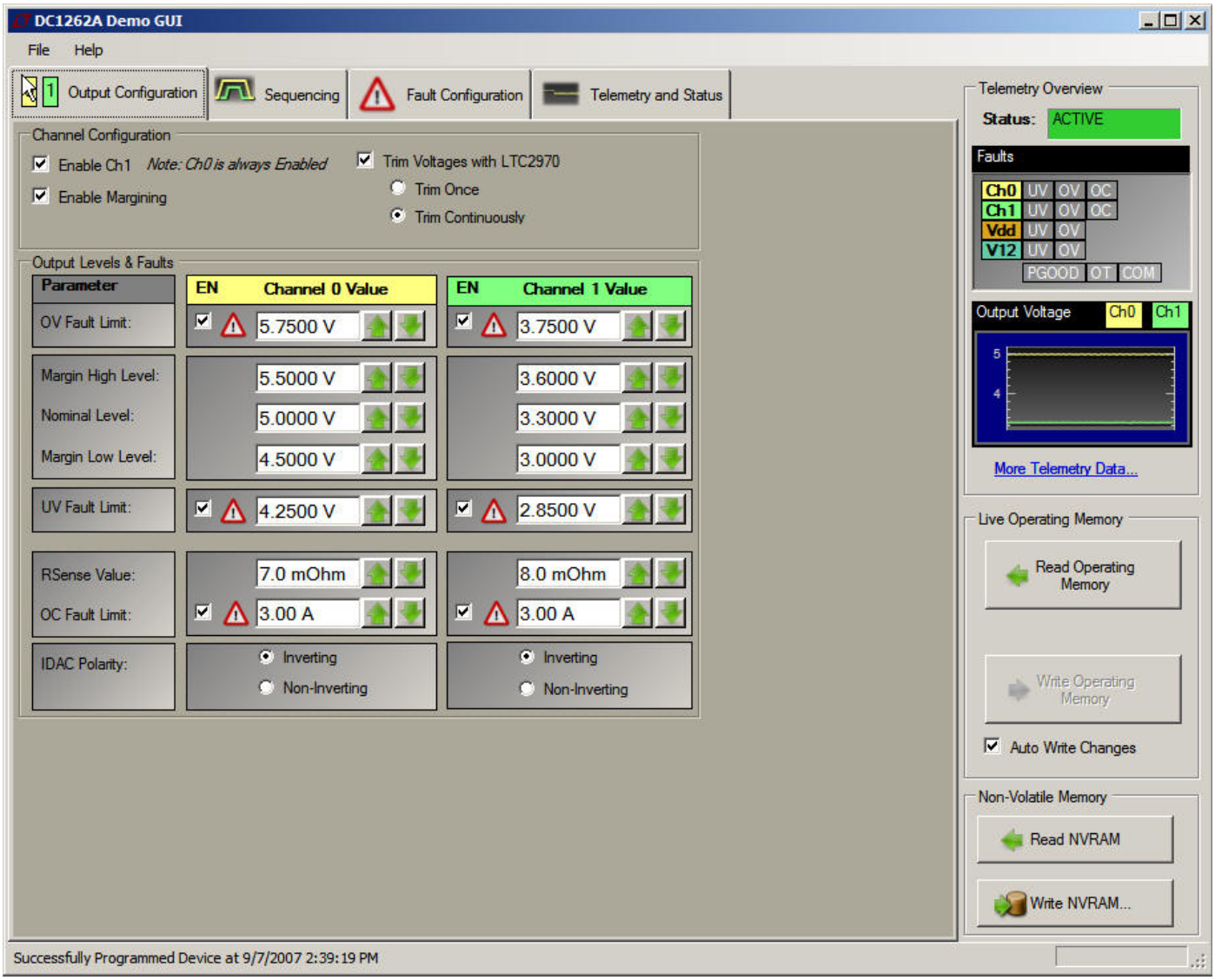


Figure 1. Demo GUI - Top Level View

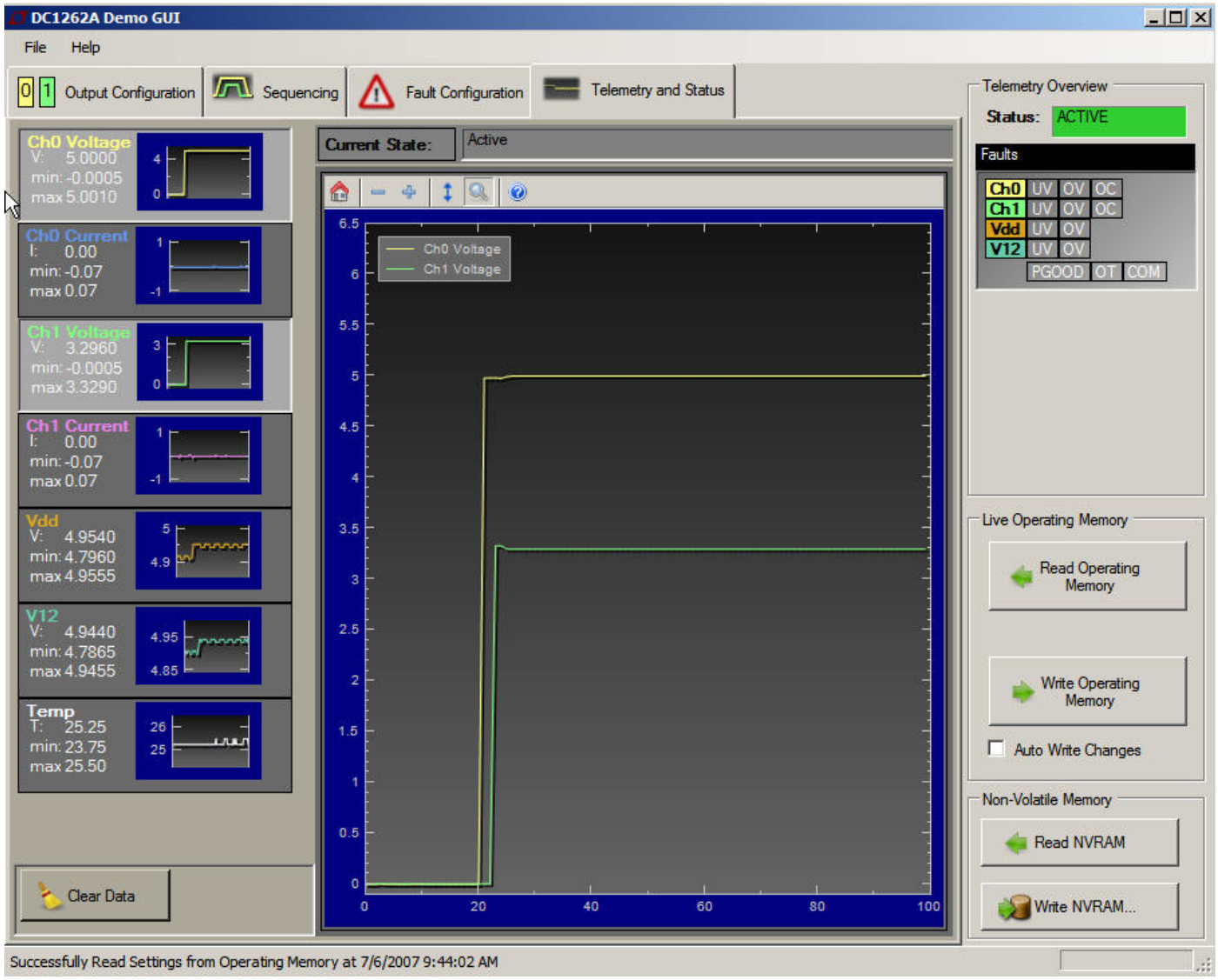


Figure 2. Demo GUI – Telemetry View- Startup Marching Waveforms

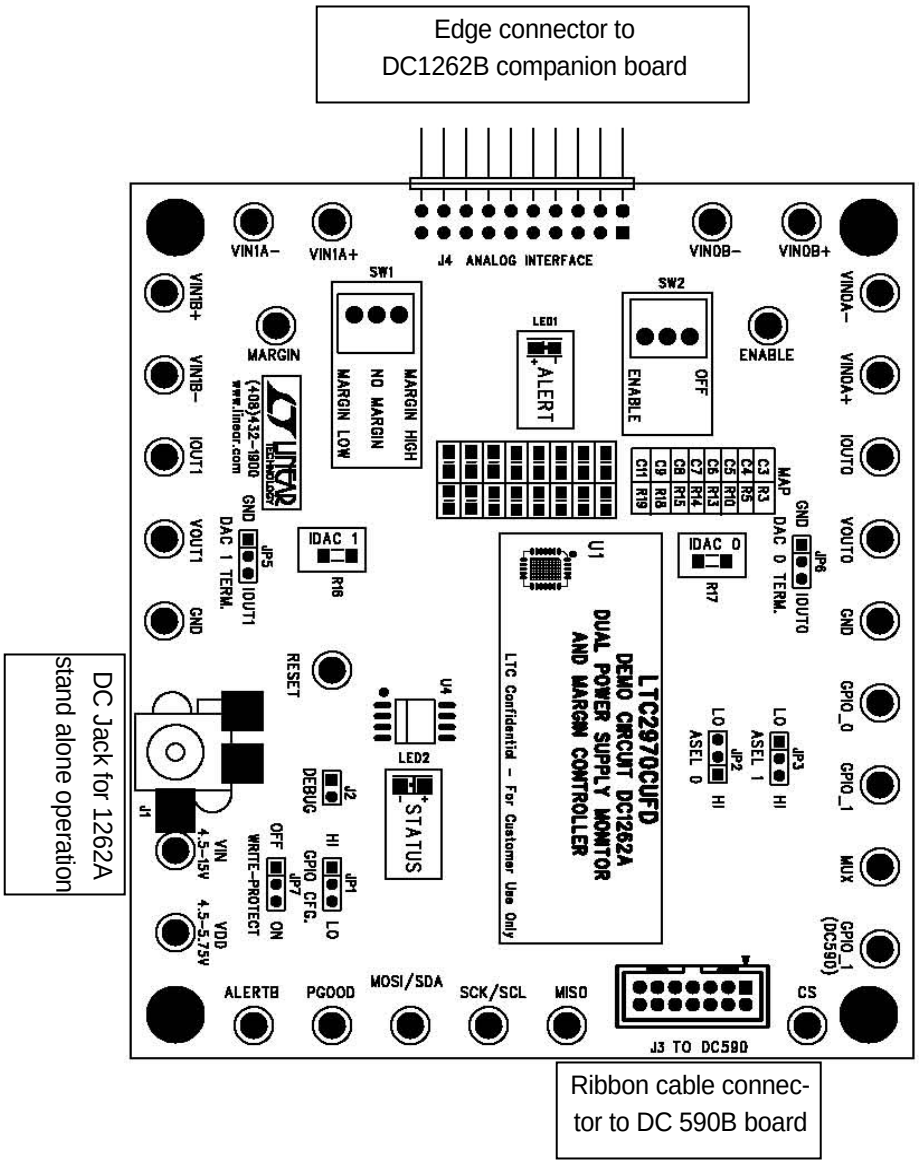


Figure 3. Connections for DC1262A Board

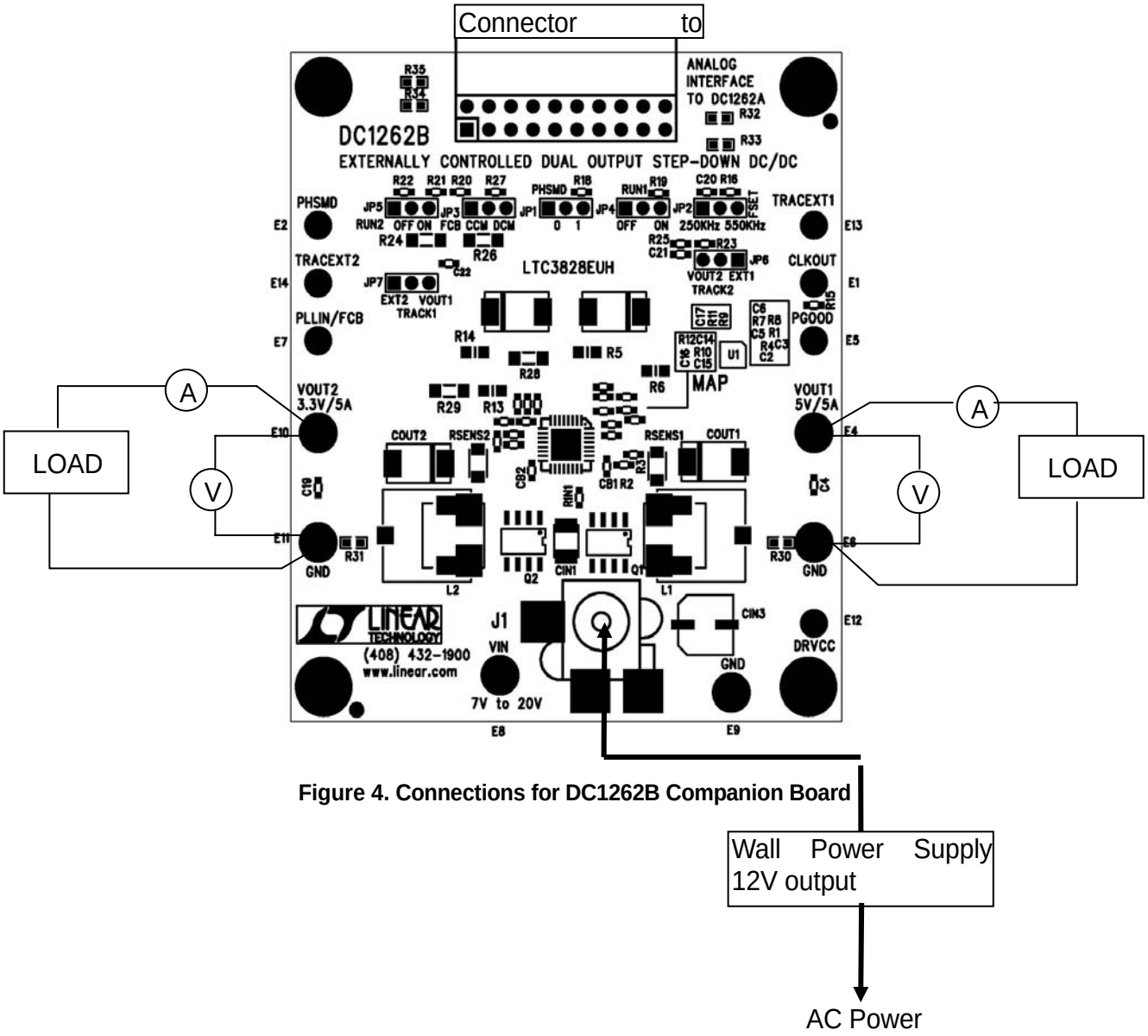
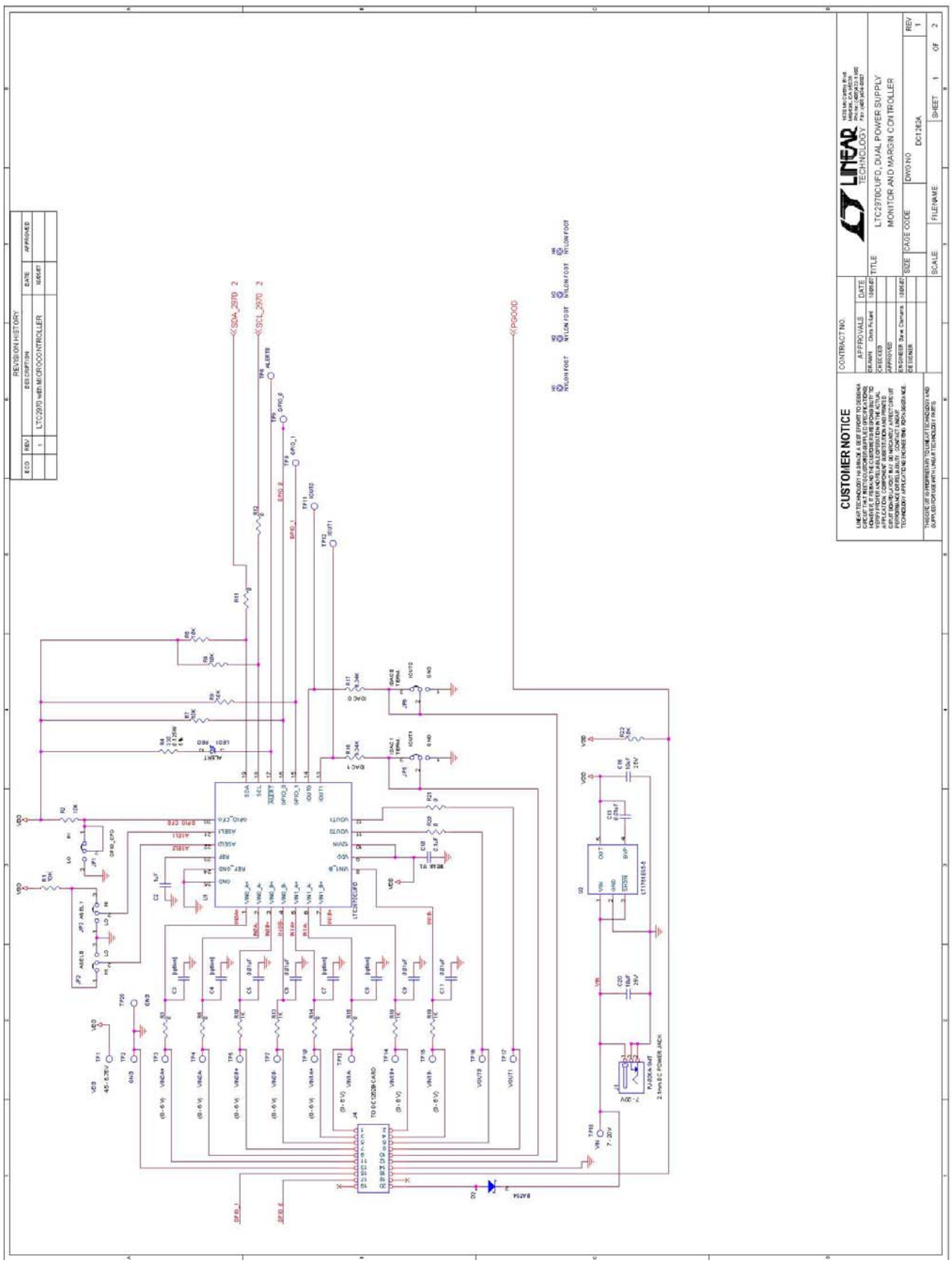
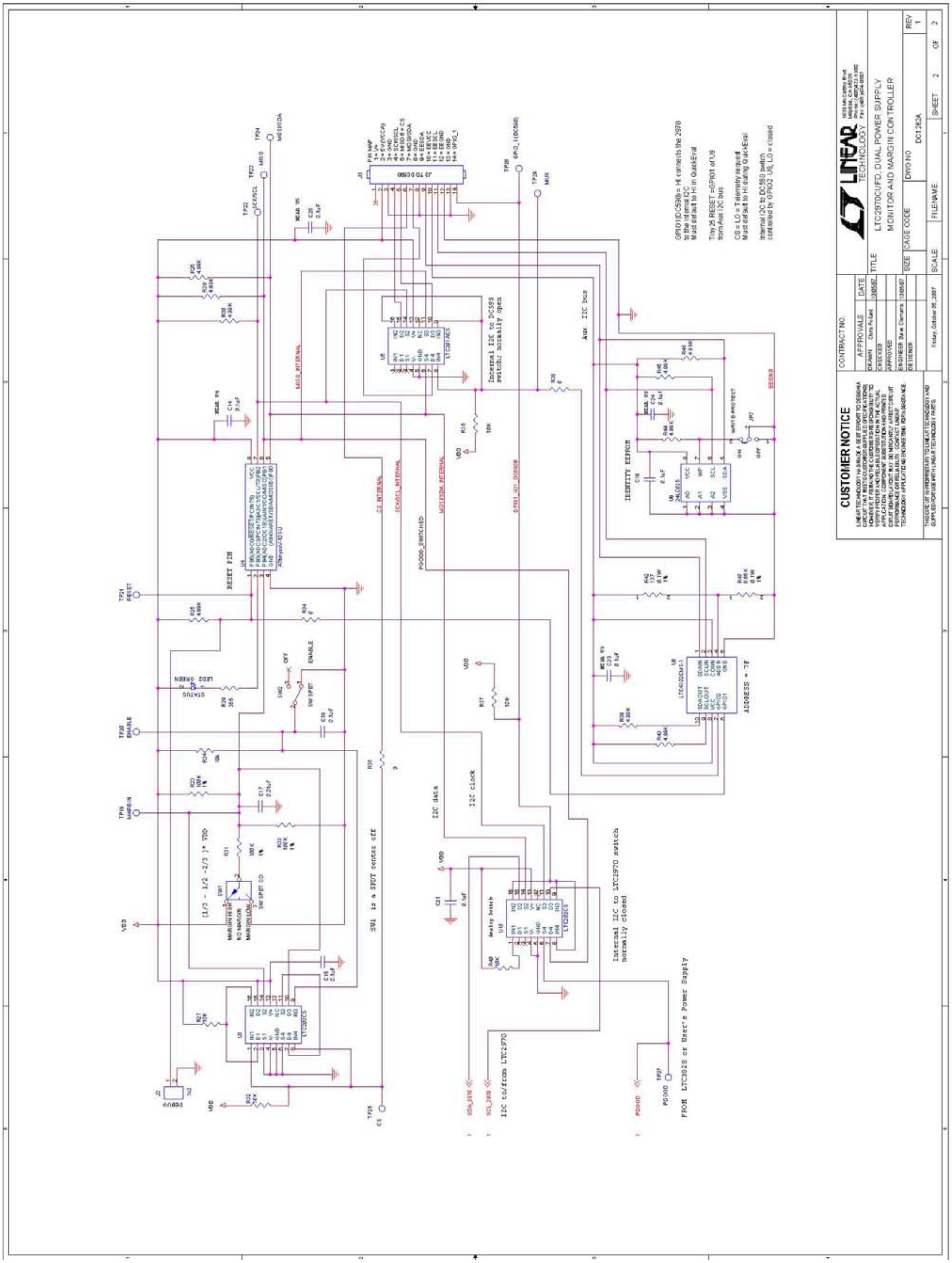
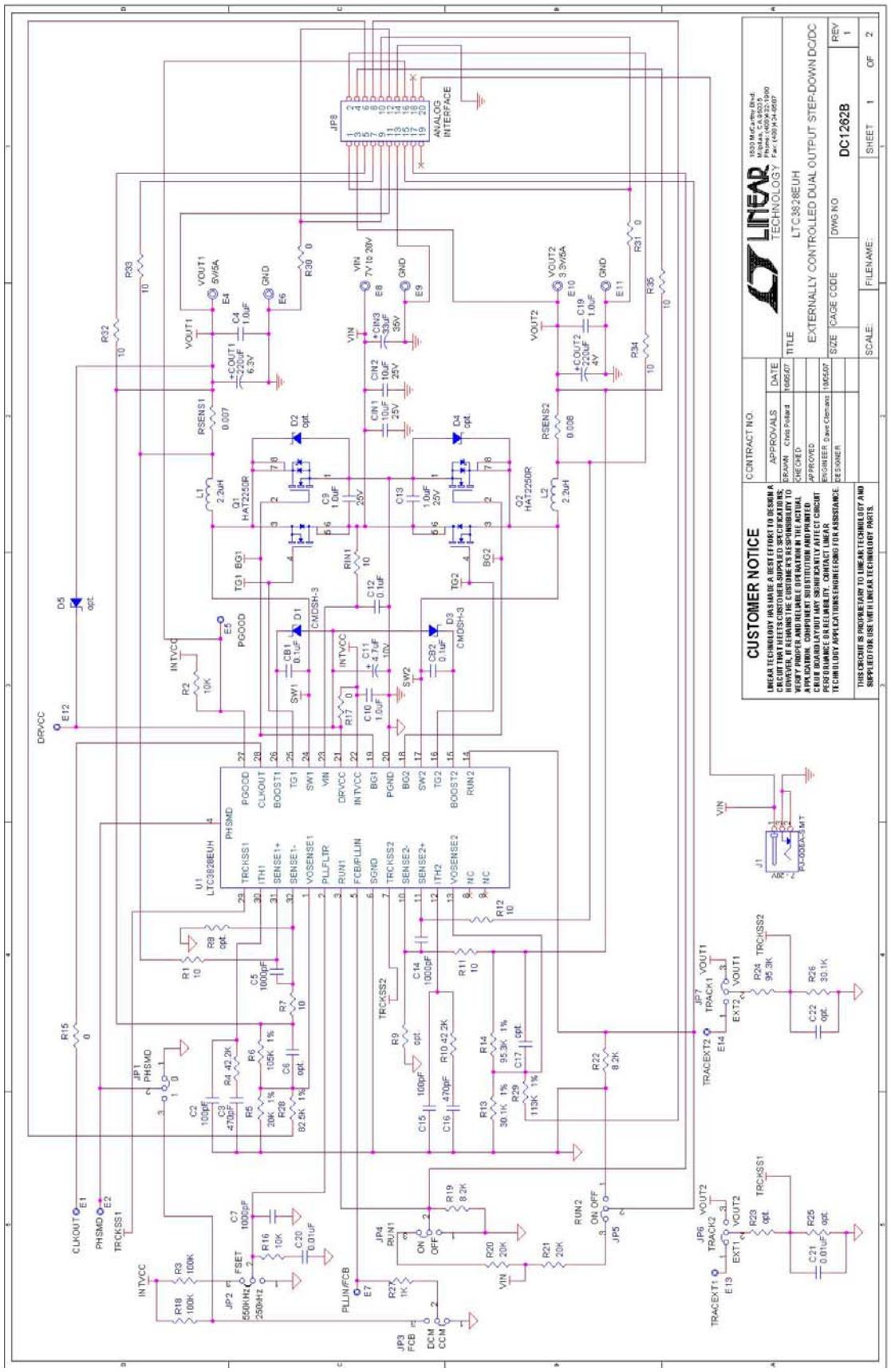
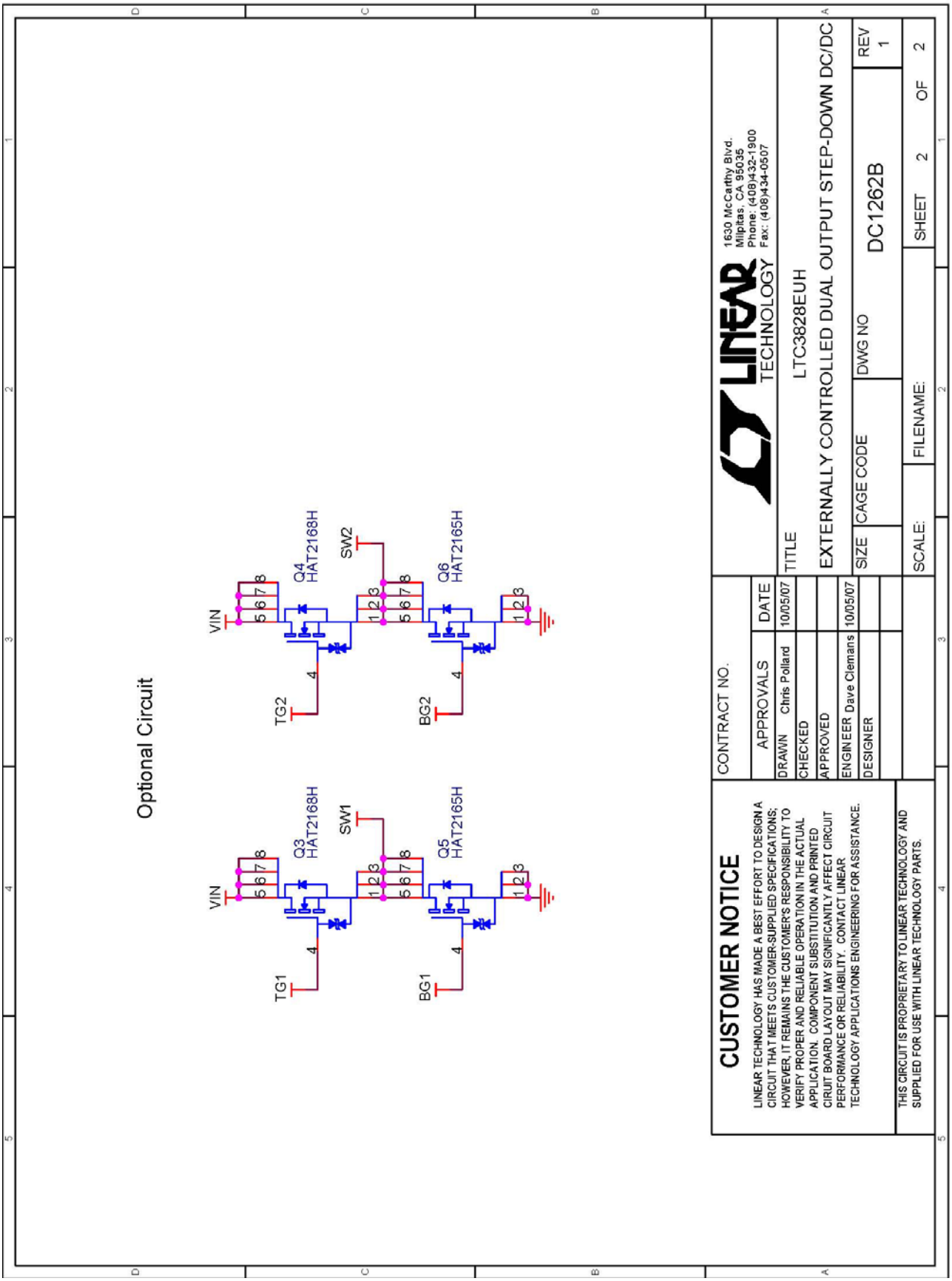


Figure 4. Connections for DC1262B Companion Board




CUSTOMER NOTICE
LTC2970CUFD, DUAL POWER SUPPLY
MONITOR AND MARGIN CONTROLLER
DC1262A


LTC3828EUH
DC1262B
EXTERNALLY CONTROLLED DUAL OUTPUT STEP-DOWN DC/DC
CUSTOMER NOTICE
ANALOG INTERFACE
VOUT1 5V/6A
VOUT2 3.3V/6A
VIN 7V to 20V


Optional Circuit
VIN
Q3
HAT2168H
SW1
Q5
HAT2165H
TG1
BG1
VIN
Q4
HAT2168H
SW2
Q6
HAT2165H
TG2
BG2
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 CIRUIT 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.
CONTRACT NO.
APPROVALS
DATE
DRAWN Chris Polland 10/05/07
CHECKED
APPROVED
ENGINEER Dave Clemans 10/05/07
DESIGNER
LINEAR TECHNOLOGY
1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900
Fax: (408)434-0507
TITLE
LTC3828EUH
EXTERNALLY CONTROLLED DUAL OUTPUT STEP-DOWN DC/DC
SIZE
CAGE CODE
DWG NO
DC1262B
REV
1
SCALE:
FILENAME:
SHEET 2 OF 2

Linear Technology Corporation

Bill Of Material
Demo Bd. DC1262A
10/16/2007

Item	Qty	Reference	Part Description	Manufacturer / Part #
REQUIRED CIRCUIT COMPONENTS[1]				
1	2	C2,C10	CAP, 0805 1uF 10% 16V X7R	TDK C2012X7R1C105K
2	6	R1,R2,R6,R7,R8,R9	RES, 0603 10K OHMS 5% 1/16W	VISHAY CRCW0603103JRT6
3	2	R16,R17	RES, 1206 6.34K OHMS 1% 1/4W	VISHAY CRCW12066K34FKEA
4	1	R4	RES, 0805 330 OHM 5% 1/10W	AAC CR10-331JM
5	1	U1	IC, LTC2970CUFD	LINEAR TECH. LTC2970CUFD
6	1	U4	MICROCONTROLLER, ATTINY85V-10SU	ATMEL ATTINY85V-10SU : alternalte pre-programmed part available from: Arrow, AT85-LTC01
7	1	C14	CAP, 0603 0.1uF 20% 16V X7R	AVX 0603YC104MAT
8	1	R23	RES, 0603 100K OHMS 1% 1/10W	VISHAY CRCW0603100KFKEA
9	1	R25	RES, 0603 4.99K OHMS 1% 1/10W	AAC CR16-4991FM
10	1	C10	CAP, 0805 0.1uF 20% 16V X7R	AVX 0805YC104MAT
ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS[2]				
1	1	C13	CAP, 0603, .01uF 20% 25V, X7R	AVX 06033C103KAT
2	1	C17	CAP, 0805, .01uF 20% 25V, X7R	AVX 0805YC103MAT
3	4	C5,C6,C9,C11	CAP, 0805, .01uF 20% 25V, X7R	AVX 0805YC103MAT
4	2	C16,C20	CAP, 1210, 10uF 20% 25V, X7R	TDK C3225X7R1E106M
5	0	C3,C4,C7,C8	OPTION - DO NOT STUFF	AVX 0805YC103MAT
6	1	C18	CAP, 0805 0.1uF 20% 16V X7R	AVX 0805YC104MAT
7	7	C15,C19,C21,C22,C23,C24,C25	CAP, 0603 0.1uF 20% 16V X7R	AVX 0603YC104MAT
8	1	D2	DIODE, SCHOTTKY 200mW SOT-23	DIODES INC. BAT54
9	2	R31,R33	RES, 0603 100K OHMS 1% 1/10W	VISHAY CRCW0603100KFKEA
10	8	R26,R28,R30,R39,R43,R44,R45,R46	RES, 0603 4.99K OHMS 1% 1/10W	AAC CR16-4991FM
11	1	R29	RES, 0603 365 OHMS 1% 1/10W	VISHAY CRCW0603365RFKEA
12	4	R3,R5,R14,R15	RES, 0805 0 OHM JUMPER	VISHAY CRCW08050000Z0EA
13	4	R10,R13,R18,R19	RES, 0805 1K OHMS 1% 1/10W	VISHAY, CRCW08051K00FKEA
14	8	R11,R12,R20,R21,R34,R35,R38,R41	RES, 0603 0 OHM JUMPER	VISHAY CRCW06030000Z0EA
15	7	R22,R24,R27,R32,R37,R36,R40	RES, 0603 10K OHMS 5% 1/16W	VISHAY CRCW0603103JRT6
16	1	R42	RES, 0603 137 OHMS 1% 1/10W	VISHAY CRCW0603137RFKEA
17	1	R47	RES, 0603 8.66K OHMS 1% 1/10W	CR16-8661FM
18	1	SW1	SWITCH, TOGGLE., SPDT, T.H., ON-OFF-ON	NKK B13AP
19	1	SW2	SWITCH, TOGGLE., SPDT, T.H., ON-ON	NKK B12AP
20	1	U2	LT1761ES5-5	LINEAR TECH.LT1761ES5-5
21	2	U3,U10	LTC202CS	LINEAR TECH.LTC202CS
22	1	U5	LTC201ACS	LINEAR TECH.LTC201ACS
23	1	U8	LTC4302CMS-1	LINEAR TECH.LTC4302CMS-1
24	1	U9	IC, SERIAL EEPROM	MICROCHIP 24LC025-I/ST
25	1	LED1	LED, RED, DIFFUSED, 0805	CML CMDA5AR7D1S
26	1	LED2	LED, GREEN, DIFFUSED, 1206	LNJ311G8TRU
HARDWARE-FOR DEMO BOARD ONLY:				
1	1	Cable for DC590A to LTC2970CUFD demo b	CABLE ASSY., 8" STRIP	RIBBON CABLE CA-2440
2	4	H1,H2,H3,H4	STANDOFF, SNAP-ON	KEYSTONE 8831
3	1	J1	CONN POWER JACK 2X5.5MM VERT SMD	CUI, PJ-006A-SMT
4	1	J2	HEADER, 2 PINS, 2mm	HIROSE DF3-2P-2DSA(01)
5	1	J3	HEADER, 2X7P 2mm	MOLEX, 87831-1420
6	1	J4	Header, 2x10 pins, Right Angle	MILL-MAX 802-40-020-20-001
7	6	JP1,JP2,JP3,JP5,JP6,JP7	HEADER,3 PINS 2mm	SAMTEC TMM-103-02-L-S
8	6	shunts on JP1,JP2,JP3,JP5,JP6,JP7	Shunt for 2mm header	SAMTEC 2SN-BK-G
9	1	PC Board	PC Board, DC1262A	Fab, DC1262A
10	29	TP1-TP29	TEST POINT, TURRET, .061" DIAMETER	MIL-MAX 2308-2-00-44-00-00-07-
	Notes:			
	1. Required Circuit Components are those parts that are required to implement the circuit function			
	2. Additional Demo Board Circuit Components are those parts that provide added functionality for the demo board but are not required in the actual circuit.			

Linear Technology Corporation

Bill Of Material
Demo Bd. DC1262B
10/16/2007

Item	*Qty*	*Reference*	*Part Description*	*Manufacturer / Part #*
REQUIRED CIRCUIT COMPONENTS[1]				
1	3	CB1,CB2,C12	CAP., X7R, 0.1uF, 10V, 10% 0603	AVX, 0603ZC104KAT2A
2	2	CIN2,CIN1	CAP., X7R, 10uF, 25V, 20% 1210	TDK, C3225X7R1E106M
3	1	CIN3	CAP., ALUM., 33uF, 35V, 20%	SANYO, 35CV33BS
4	1	COUT1	CAP., POSCAP, 220uF, 6.3V, 7343	SANYO, 6TPE220MI
5	1	COUT2	CAP., POSCAP, 220uF, 4V, 7343	SANYO, 4TPE220MF
6	2	C2,C15	CAP., C0G, 100pF, 50V, 5% 0603	AVX, 06035A101JAT2A
7	2	C3,C16	CAP, C0G, 470pF, 50V, 5% 0603	AVX, 06035A471JAT2A
8	3	C5,C7,C14	CAP., C0G, 1000pF, 50V, 5% 0603	AVX, 06035A102JAT2A
9	3	C4,C10,C19	CAP., X5R, 1.0uF, 10V, 10% 0603	TDK, C1608X5R1A105K
10	2	C9,C13	CAP., X7R, 1.0uF, 25V, 10% 0805	TDK, C2012X7R1E105K
11	1	C11	CAP., TANT, 4.7uF, 10V, 0805	AVX, TACR475M010R 0805
12	2	C20,C21	CAP., X7R, 0.01uF, 50V, 10% 0603	AVX, 06035C103KAT2A
13	2	D1,D3	Schottky Diode, CMDSH-3, SOD-323	CENTRAL SEMI., CMDSH-3-LTC
14	2	L2,L1	INDUCTOR, 2.2uH	TOKO, FDV0630-2R2M
15	2	Q2,Q1	N-Chan. HAT2250R, SO8	RENESAS, HAT2250R
16	5	R1,R7,R11,R12,RIN1	RES., CHIP, 10, 1/16W, 5% 0603	AAC, CR16-100JM
17	1	RSENS1	RES., CHIP, 0.007, 1/4W, 5% 1206	IRC, LRF1206-01-R007-J 1206
18	1	RSENS2	RES., CHIP, 0.008, 1/4W, 5% 1206	IRC, LRF1206-01-R008-J 1206
19	2	R2,R16	RES., CHIP, 10K, 1/16W, 5% 0603	VISHAY, CRCW0603103JRT6
20	2	R3,R18	RES., CHIP, 100K, 1/16W, 5% 0603	AAC, CR16-104JM
21	2	R4,R10	RES., CHIP, 42.2K, 1/16W, 1% 0603	AAC, CR16-4222FM
22	2	R20,R21	RES., CHIP, 20K, 1/16W, 1% 0603	AAC, CR16-2002FM
23	1	R5	RES, CHIP, 20K, 1/8W, 1% 0805	CR10-2002FM
24	1	R13	RES., CHIP, 30.1K, 1/16W, 1% 0805	CR10-3012FM
25	1	R26	RES., CHIP, 30.1K, 1/16W, 1% 1206	YAGEO, RC1206FR-0730K1L
26	1	R6	RES,CHIP, 105K, 1/8W, 1% 0805	VISHAY, CRCW0805105KFKEA
27	1	R14	RES., CHIP, 95.3K, 1/16W, 1% 0805	AAC, CR10-9532FM
28	1	R24	RES., CHIP, 95.3K 1/4W, 1% 1206	VISHAY, CRCW120695K3FKEA
29	2	R19,R22	RES., CHIP, 8.2K 1/16W, 5% 0603	AAC, CR16-822JM
30	1	R27	RES., CHIP, 1K 1/16W, 5% 0603	AAC, CR16-102JM
31	1	U1	I.C., LTC3828EUH, QFN-5X5 Exposed	LINEAR., LTC3828EUH
32	1	R28	RES, CHIP, 82.5K, 1/4W, 5% 1206	VISHAY, CRCW120682K5FKEA
33	1	R29	RES, CHIP,113K, 1/8W, 1% 1206	VISHAY, CRCW1206113KFKEA
ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS[2]				
1	4	R15,R17,R30,R31	RES., CHIP, 0 OHM, 1/16W, 0603	VISHAY, CRCW0603000ZRT6
2	4	R32-R35	RES., CHIP, 10, 1/16W, 5% 0603	AAC, CR16-100JM
3	0	C6,C17,C22 (OPT.)	CAP., 0603	*Do not stuff*
4	0	D4,D2 (OPT.)	DIODE, POWERMITE	*Do not stuff*
5	0	D5 (OPT.)	DIODE, SOT-323	*Do not stuff*
6	0	R8,R9,R23,R25 (OPT.)	RES., CHIP, 0603	*Do not stuff*
7	0	Q3,Q4 (OPT.)	MOSFET, N-CH, PWR SW RENESAS, HAT2168H	*Do not stuff*
8	0	Q5,Q6 (OPT.)	MOSFET, N-CH, PWR SW RENESAS, HAT2165H	*Do not stuff*
HARDWARE-FOR DEMO BOARD ONLY:				
1	4	STAND-OFF	STAND-OFF, NYLON 0.25" tall	KEYSTONE, 8831
2	7	E1,E2,E5,E7,E12-E14	TURRET TESTPOINT, .061"	Mill Max, 2308-2-00-44-00-00-07-0
3	6	E4,E6,E8-E11	TURRET TESTPOINT, .094"	Mill Max, 2501-2-00-44-00-00-07-0
4	7	JP1-JP7	0.079 SINGLE ROW HEADER, 3 PIN	SAMTEC, TMM-103-02-L-S
5	7	shunts on JP1-JP7	SHUNT, 2mm	SAMTEC, 2SN-BK-G
6	1	JP8	SOCKET, 2x10 RIGHT ANGLE	MILL-MAX 803-93-020-20-001
7	1	J1	CONN POWER JACK 2X5.5MM VERT SMD	CUI, PJ-006A-SMT
	Notes:			
	1. Required Circuit Components are those parts that are required to implement the circuit function			
	2. Additional Demo Board Circuit Components are those parts that provide added functionality for the demo board but are not required in the actual circuit.			