

# LTC4000EGN(-1)/LTC3789EGN 14.6V, 5A Battery Charger with 6V<sub>IN</sub> to 36V<sub>IN</sub> Buck-Boost Converter

## DESCRIPTION

Demonstration circuit 1721B is a 14.6V, 5A battery charger and PowerPath™ manager with 6V<sub>IN</sub> to 36V<sub>IN</sub> buck-boost converter featuring the LTC4000/LTC3789, targeted at 4-cell LiFePO<sub>4</sub> applications. The output of this demo board was specifically tailored for a Tenergy 10A-hour battery, P/N 30207. Other voltages can be set by changing ROFB2 and RBFB2. The desired nominal voltage can be accurately trimmed by using trim resistors R42 and R43. For example, for 14.4V battery float voltage, change ROFB2 and RBFB2 to 86.6k, and add 7.5M at R42 and R43 for greater set point accuracy.

This circuit was designed to demonstrate the high levels of performance, efficiency, and small solution size attainable using these ICs in a buck-boost converter battery charger, intelligent PowerPath manager, and power supply. It operates at 400kHz and produces a regulated 5A/14.6V battery charger output as well as a system output of up to 6.25A from an input voltage range of 6V to 36V: suitable for a

wide variety of portable applications including instruments, industrial equipment, power tools, and computers. It has a total footprint area of 12.4cm<sup>2</sup> (3.6cm<sup>2</sup> for the LTC4000 circuit only). Synchronous rectification helps to attain efficiency exceeding 96% at full load and nominal input.

**DC1721B-A:** The LTC4000 has an input current limit/regulation loop that prevents overloading sources with limited output capability.

**DC1721B-B:** The LTC4000-1 instead has an input voltage regulation loop for Maximum Power Point (MPP) control. MPP control extracts near maximum power from high impedance sources such as solar panels, wind turbines, or fuel cells.

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

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## PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V <sub>IN</sub>	Input Supply Range		6		36	V
V <sub>IN-MP</sub> <sup>1</sup>	Input Regulation Voltage	This Is the Input Voltage Lower Limit Set by the LTC4000-1		11.85		V
I <sub>IN</sub> <sup>2</sup>	Input Current Limit			11		A
V <sub>FLOAT</sub>	Battery Float Voltage		14.4	14.6	14.8	V
	Output Regulation	Line and Load (6V to 36V, 0A to 5A)		±0.05		%
I <sub>BAT</sub>	Battery Charge Current			5.0		A
V <sub>OUT-SYS</sub>	System Output Voltage		12.3	14.6	15.5	V
I <sub>OUT-SYS</sub>	System Output Current Range		0		6.25	A
F <sub>SW</sub>	Switching (Clock) Frequency			400		kHz
V <sub>OUT-SYS P-P</sub>	System Output Ripple	V <sub>IN</sub> = 24V, I <sub>OUT-SYS</sub> = 5A (20MHz BW)		50		mV <sub>P-P</sub>
P <sub>OUT</sub> /P <sub>IN</sub>	System Output Efficiency (See Figure 3)	V <sub>IN</sub> = 24V, I <sub>OUT-SYS</sub> = 5A		96.5		%
	Approximate Size	Component Area × Top Component Height		12.4cm <sup>2</sup> × 0.40cm		

<sup>1</sup> DC1721B-B (LTC4000-1) Only,

<sup>2</sup> DC1721B-A (LTC4000) Only

### QUICK START PROCEDURE

Demonstration circuit 1721 is easy to set up to evaluate the performance of the LTC4000/LTC3789. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

**WARNING: BATTERIES ARE POTENTIALLY DANGEROUS HIGH ENERGY SOURCES. IMPROPER CONNECTION, OVERCHARGE, OR RAPID DISCHARGE COULD RESULT IN EXPLOSION AND/OR FIRE.**

NOTE. When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last output capacitor as shown in Figure 1.

1. Set MODE jumper to CCM. Set CHARGE jumper to DISABLE.
2. Set an input power supply that is capable of 6V to 36V and 12A to 24V. Then turn off the supply.
3. With power off, connect the supply to the input terminals VIN and GND.

NOTE.

- a. Input voltages lower than 6V can keep the converter from turning on due to the undervoltage lockout feature of the LTC4000.
  - b. If efficiency measurements are desired, refer to Figure 1 for test setup.
4. Turn on the power at the input.

NOTE. Make sure that the input voltage never exceeds 36V.

5. Check for the proper VOUT-SYS of 15.3V. Turn off the power at the input.
6. Once the proper output voltages are established, connect a variable load capable of sinking 7A at 16V to the output terminals VOUT-SYS and GND. Set the current for 0A.

7. Turn on the power at the input.

NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

8. Once the proper VOUT-SYS is again established, adjust the load and/or source within the operating range and observe the output voltage regulation, ripple voltage, efficiency, input and output current limit, and other desired parameters.
9. Turn off the power at the input.
10. Connect the output load and meters to the BAT output.
11. Set CHARGE jumper to ENABLE.
12. Turn on the power at the input.
13. Once the proper VOUT-SYS is again established, adjust the load and/or source within the operating range and observe the battery float voltage regulation and other desired parameters.
14. Set the load to constant voltage mode to more easily observe charge current and trickle charge current.
15. **(DC1721B-B ONLY)** In order to observe MPP operation, add a 0.25Ω to 0.3Ω, 10W resistor in series with the DC source and set the source to 13V. Use a constant voltage or constant resistance load characteristic. As the load is increased, the input voltage will be regulated at the MPP regulation point (11.75V) by reducing the output of the DC/DC converter.

NOTE. Operation in the Instant-On region ( $V_{OUT} < 12.5V$ ) may engage thermal limit circuit to protect Q7 in the linear region.

NOTE. The optional thermal limit circuit for Q6 (Q9, RNTC3, R55-59, and U4) is included to protect Q6 in case of an extended short circuit on VOUT-SYS under adverse thermal conditions ( $T_A > 40^{\circ}C$ ). It may not be needed in applications with less severe thermal conditions, lower current available to VOUT-SYS, or where continuous short-circuit protection on VOUT-SYS is not required.

### QUICK START PROCEDURE

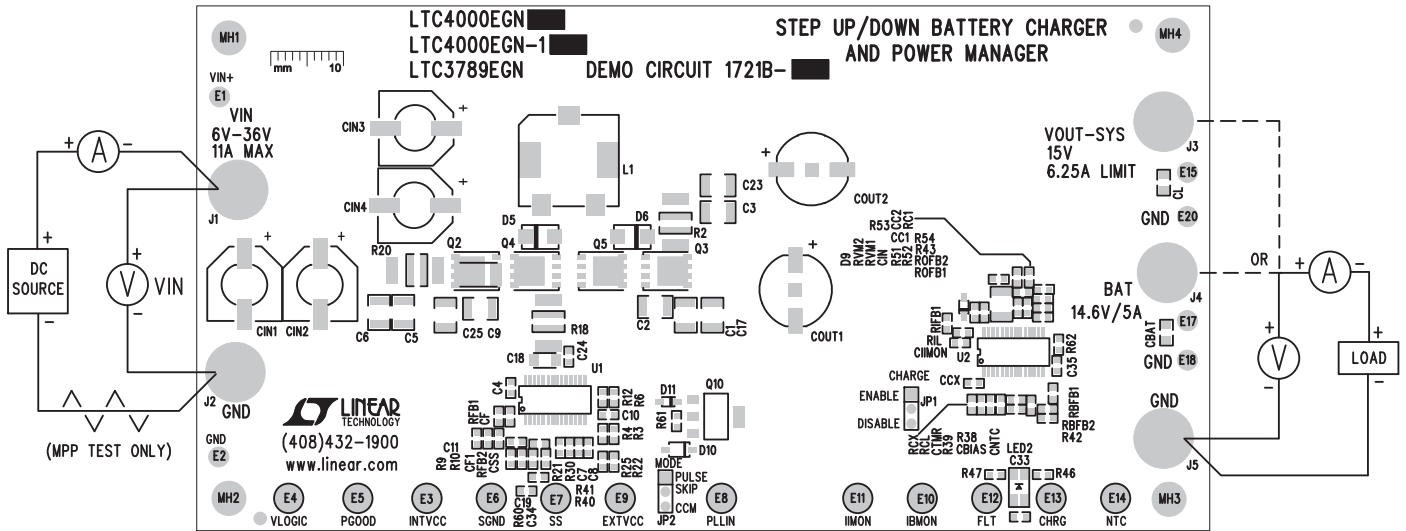


Figure 1. Proper Measurement Equipment Setup

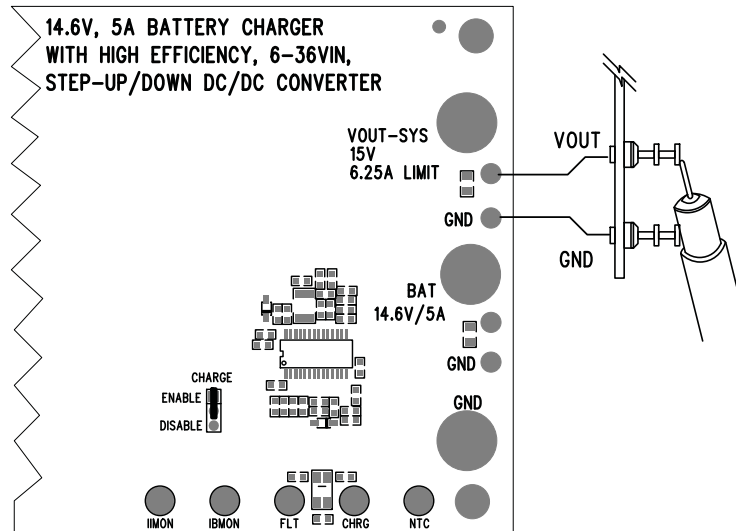


Figure 2. Proper Noise Measurement Setup

### QUICK START PROCEDURE

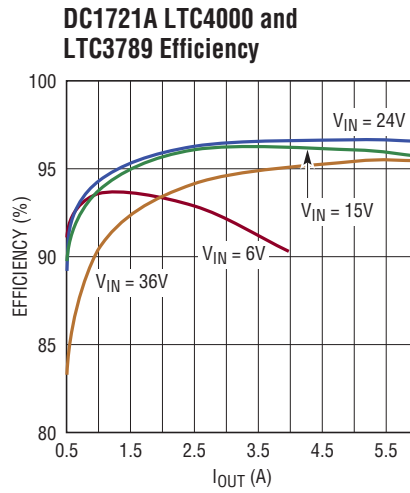


Figure 3. Efficiency from  $V_{IN}$  to  $V_{OUT-SYS}$

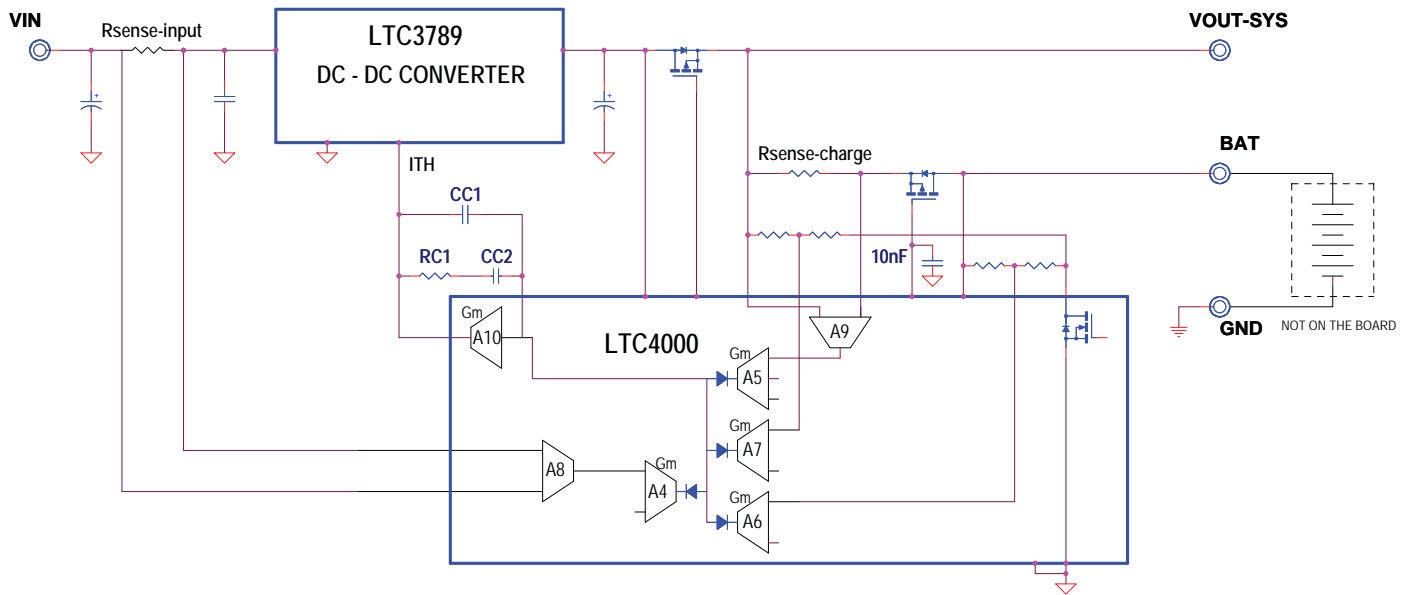


Figure 4. LTC4000/LTC3789 System Block Diagram, DC1721B-A

## QUICK START PROCEDURE

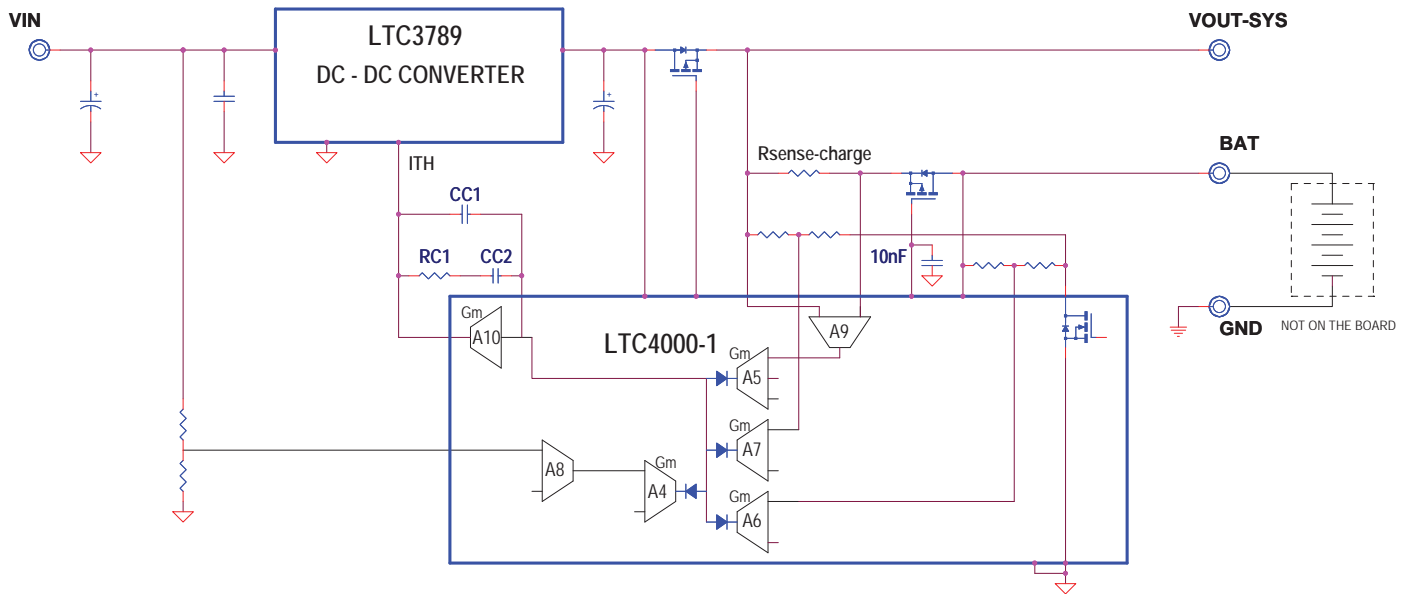


Figure 5. LTC4000-1/LTC3789 System Block Diagram, DC1721B-B

# DEMO MANUAL

## DC1721B-A/DC1721B-B

### PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>DC1721B-A Required Circuit Components</b>				
1	4	C1, C2, C16, C17	CAP., X5R, 22µF, 25V, 10% 1210	AVX, 12103D226KAT2A
2	2	C4, C22	CAP., X7R, 0.22µF, 16V, 10% 0603	AVX, 0603YC224KAT2A
3	4	C5, C6, C9, C25	CAP., X7R, 3.3µF, 50V, 10% 1210	AVX, 12105C335KAT2A
4	1	C10	CAP., X5R, 2.2µF, 6.3V, 20% 0603	AVX, 06036D225MAT2A
5	1	C12	CAP., NPO, 390pF, 100V, 5% 1206	AVX, 12061A391JAT2A
6	1	C13	CAP., NPO, 1800pF, 100V, 5% 1206	AVX, 12061A182JAT2A
7	2	C15, CIN	CAP., X7R, 1µF, 50V, 10% 1210	AVX, 12105C105KAT2A
8	1	C18	CAP., X7R, 10µF, 10V, 10% 1206	AVX, 1206ZC106KAT2A
9	1	C19	CAP., C0G, 1000pF, 25V, 5% 0603	AVX, 06033A102JAT2A
10	2	C24, CBIAS	CAP., X7R, 1µF, 16V, 10% 0603	AVX, 0603YC105KAT2A
11	2	C34, C35	CAP., X7R, 0.01µF, 25V, 5% 0603	AVX, 06033C103JAT2A
12	3	CC2, C14, CTMR	CAP., X7R, 0.1µF, 50V, 10% 0603	AVX, 06035C104KAT2A
13	2	CIN1, CIN2	CAP., ALUM., HVH, 56µF, 50V	SUN Electronics, 50HVH56M
14	1	CL	CAP., X5R, 2.2µF, 25V, 20% 0805	AVX, 08053D225MAT2A
15	2	COU1, COU2	CAP., OS-CON, 150µF, 20V, 20%	SANYO, 20SVP150M
16	1	CSS	CAP., X7R, 0.022µF, 50V, 10%, 0603	AVX, 06035C223KAT2A
17	1	D2	DIODE, SWITCH 75V 350MW SOT23-3	DIODES/ZETEX, BAS16-7-F
18	1	D10	DIODE, ZENER 5.6V 500MW SOD-123	DIODES/ZETEX, BZT52C5V6-7-F
19	2	D4, D7	DIODE, SCHOTTKY 1A 60V POWERDI123	DIODES/ZETEX, DFSL160-7
20	2	D5, D6	DIODE, SCHOTTKY 40V 2A SMA	DIODES/ZETEX, B240A-13-F
21	1	D9	DIODE, ZENER 3V 500MW SOD-323	DIODES/ZETEX, BZT52C3V0S-7-F
22	1	F1	FUSE, 6.3A 32V T-LAG 1206 SMD	COOPER BUSSMAN, 3216TD6.3-R
23	1	L1	INDUCTOR, 4.7µH	TOKO, FDA1254-4R7M
24	2	Q2, Q4	MOSFET, N-Chan., 40V, POWERPAK-8	VISHAY, SiR422DP-T1-GE3
25	2	Q3, Q5	MOSFET, N-Chan., 20V, POWERPAK-8	VISHAY, SiR496DP-T1-GE3
26	2	Q6, Q7	MOSFET, P-Chan., 30V, POWERPAK-8	VISHAY, Si7135DP-T1-GE3
27	2	Q8, Q9	MOSFET, SMALL SIGNAL SOT23	ON SEMI., 2N7002LT1G
28	1	R1	RES., CHIP., 5.6Ω, 0.1W, 5% 0603	VISHAY, CRCW06035R60JNEA
29	2	R2, R18	SENSOR RES 0.008Ω 1W 2% 0815 SMD	SUSUMU, RL3720WT-R008-G
30	4	R3, R4, R13, R14	RES., CHIP., 100Ω, 0.1W, 5%, 0603	VISHAY, CRCW0603100RJNEA
31	1	R5	RES., CHIP., 15Ω, 0.125W, 5% 0805	VISHAY, CRCW080515R0JNEA
32	2	R7, R49	RES., CHIP., 100k, 0.1W, 1% 0603	VISHAY, CRCW0603100KFKEA
33	2	R8, R11	RES., CHIP., 10Ω, 0.1W, 5% 0603	VISHAY, CRCW060310R0JNEA
34	2	R9, R10	RES., CHIP., 1.24k, 0.1W, 1% 0603	VISHAY, CRCW06031K24FKEA
35	1	R20	SENSOR RES 0.004Ω 1W 2% 0815 SMD	SUSUMU, RL3720WT-R004-G
36	1	R21	RES., CHIP., 121k, 0.1W, 1% 0603	VISHAY, CRCW0603121KFKEA
37	6	R24, R48, R55, R60, RCX, RVM2	RES., CHIP., 10k, 0.1W, 1% 0603	VISHAY, CRCW060310K0FKEA
38	1	R28	RES., CHIP, 5.6Ω, 5%, 1206	VISHAY, CRCW12065R60JNEA
39	1	R29	RES., CHIP, 3.6Ω, 5%, 1206	VISHAY, CRCW12063R60JNEA
40	2	R44, R58	RES., CHIP., 38.3k, 0.1W, 1% 0603	VISHAY, CRCW060338K3FKEA
41	2	R50, R57	RES., CHIP., 20k, 0.1W, 1% 0603	VISHAY, CRCW060320K0FKEA

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### PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
42	1	R56	RES., CHIP., 68.1k, 0.1W, 1% 0603	VISHAY, CRCW060368K1FKEA
43	1	RC1	RES., CHIP., 14.7k, 0.1W, 1% 0603	VISHAY, CRCW060314K7FKEA
44	1	RCL	RES., CHIP., 24k, 0.1W, 5% 0603	VISHAY, CRCW060324K0JNEA
45	1	RCS	SENSOR RES., 0.01Ω 1W 2% 0815 SMD	SUSUMU, RL3720WT-R010-G
46	1	RFB1	RES., CHIP., 154k, 0.1W, 1% 0603	VISHAY, CRCW0603154KFKEA
47	1	RFB2	RES., CHIP., 8.06k, 0.1W, 1% 0603	VISHAY, CRCW06038K06FKEA
48	1	RIG	RES., CHIP., 10M, 0.1W, 5% 0603	VISHAY, CRCW060310MJNEA
49	1	RIL	RES., CHIP., 18.2k, 0.1W, 1% 0603	VISHAY, CRCW060318K2FKEA
50	2	RNTC2, RNTC3	THERMISTOR NTC 10k 5% 0603	VISHAY, NTCS0603E3103JMT
51	4	ROFB1, RBFB1, R45, R59	RES., CHIP., 1M, 0.1W, 1% 0603	VISHAY, CRCW06031M00FKEA
52	2	ROFB2, RBFB2	RES., CHIP., 84.5k, 0.1W, 1% 0603	VISHAY, CRCW060384K5FKEA
53	1	RVM1	RES., CHIP., 36.5k, 0.1W, 1% 0603	VISHAY, CRCW060336K5FKEA
54	1	U1	I.C., VOLT. REG.	Linear Tech., LTC3789EGN#PBF
55	1	U2	I.C. LTC4000EGN, 28 PIN SSOP	Linear Tech., LTC4000EGN#PBF
56	2	U3, U4	NANOPWR COMPARATOR, MSOP8	Linear Tech., LTC1540CMS8#PBF

#### DC1721B-A Additional Demo Board Circuit Components

57	0	C3, C23, C26, C27	OPT 1210	
58	1	C33	CAP., X5R, 4.7μF, 10V, 20% 0603	AVX, 0603ZD475MAT2A
59	1	CBAT	CAP., X5R, 2.2μF, 25V, 20% 0805	AVX, 08053D225MAT2A
60	0	CF1, CC1, R6, C7, C8, C11, R12, R22, R27, R30, R38-R43, R53, R61, R62, CNTC, CF, CCX	OPT 0603	OPT
61	2	CIIMON, CIBMON	CAP., COG, 1000pF, 25V, 5% 0603	AVX, 06033A102JAT2A
62	0	CIN3, CIN4	OPT	
63	0	D11	OPT SOD323	OPT
64	1	LED2	LED, DUAL RED/GREEN	LiteOn, LTST-C155KGJRKT
65	0	Q10	OPT SOT223	OPT
66	4	R25, R51, R52, R54	RES., 0Ω 1/16W 1A 0603	VISHAY, CRCW06030000Z0EA
67	1	R46	RES., CHIP., 2.2k, 0.1W, 5% 0603	VISHAY, CRCW06032K20JNEA
68	1	R47	RES., CHIP., 4.7k, 0.1W, 5% 0603	VISHAY, CRCW06034K70JNEA
69	0	RIFB1	OPT 0603	OPT

#### DC1721B-A Hardware: For Demo Board Only

70	6	E1, E2, E15, E17, E18, E20	TESTPOINT, TURRET, 0.061" PbF	MILL-MAX, 2308-2-00-80-00-00-07-0
71	12	E3-E14	TESTPOINT, TURRET, 0.094" PbF	MILL-MAX, 2501-2-00-80-00-00-07-0
72	5	J1, J2, J3, J4, J5	CONNECTOR, BANANA JACK	KEYSTONE, 575-4
73	2	JP1, JP2	HEADER, 3 PIN 0.079 SINGLE ROW	SAMTEC, TMM-103-02-L-S
74	4	MH1-MH4	STAND-OFF, NYLON 0.5"	KEYSTONE, 8833 (SNAP ON)
75	2	XJP1, XJP2	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G

# DEMO MANUAL

## DC1721B-A/DC1721B-B

### PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>DC1721B-B Required Circuit Components</b>				
1	4	C1, C2, C16, C17	CAP., X5R, 22 $\mu$ F, 25V, 10% 1210	AVX, 12103D226KAT2A
2	2	C4, C22	CAP., X7R, 0.22 $\mu$ F, 16V, 10% 0603	AVX, 0603YC224KAT2A
3	4	C5, C6, C9, C25	CAP., X7R, 3.3 $\mu$ F, 50V, 10% 1210	AVX, 12105C335KAT2A
4	1	C10	CAP., X5R, 2.2 $\mu$ F, 6.3V, 20% 0603	AVX, 06036D225MAT2A
5	1	C12	CAP., NPO, 390pF, 100V, 5% 1206	AVX, 12061A391JAT2A
6	1	C13	CAP., NPO, 1800pF, 100V, 5% 1206	AVX, 12061A182JAT2A
7	2	C15, CIN	CAP., X7R, 1 $\mu$ F, 50V, 10% 1210	AVX, 12105C105KAT2A
8	1	C18	CAP., X7R, 10 $\mu$ F, 10V, 10% 1206	AVX, 1206ZC106KAT2A
9	1	C19	CAP., COG, 1000pF, 25V, 5% 0603	AVX, 06033A102JAT2A
10	2	C24, CBIAS	CAP., X7R, 1 $\mu$ F, 16V, 10% 0603	AVX, 0603YC105KAT2A
11	2	C34, C35	CAP., X7R, 0.01 $\mu$ F, 25V, 5% 0603	AVX, 06033C103JAT2A
12	3	CC2, C14, CTMR	CAP., X7R, 0.1 $\mu$ F, 50V, 10% 0603	AVX, 06035C104KAT2A
13	2	CIN1, CIN2	CAP., ALUM., HVH, 56 $\mu$ F, 50V	SUN Electronics, 50HVH56M
14	1	CL	CAP., X5R, 2.2 $\mu$ F, 25V, 20% 0805	AVX, 08053D225MAT2A
15	2	COU1, COU2	CAP., OS-CON, 150 $\mu$ F, 20V, 20%	SANYO, 20SVP150M
16	1	CSS	CAP., X7R, 0.022 $\mu$ F, 50V, 10%, 0603	AVX, 06035C223KAT2A
17	1	D2	DIODE, SWITCH 75V 350MW SOT23-3	DIODES/ZETEX, BAS16-7-F
18	2	D4, D7	DIODE, SCHOTTKY 1A 60V POWERDI123	DIODES/ZETEX, DFSL160-7
19	2	D5, D6	DIODE, SCHOTTKY 40V 2A SMA	DIODES/ZETEX, B240A-13-F
20	1	D9	DIODE, ZENER 3V 500MW SOD-323	DIODES/ZETEX, BZT52C3V0S-7-F
21	1	D10	DIODE, ZENER 5.6V 500MW SOD-123	DIODES/ZETEX, BZT52C5V6-7-F
22	1	F1	FUSE, 6.3A 32V T-LAG 1206 SMD	COOPER BUSSMAN, 3216TD6.3-R
23	1	L1	INDUCTOR, 4.7 $\mu$ H	TOKO, FDA1254-4R7M
24	2	Q2, Q4	MOSFET, N-Chan., 40V, POWERPAK-8	VISHAY, SiR422DP-T1-GE3
25	2	Q3, Q5	MOSFET, N-Chan., 20V, POWERPAK-8	VISHAY, SiR496DP-T1-GE3
26	2	Q6, Q7	MOSFET, P-Chan., 30V, POWERPAK-8	VISHAY, Si7135DP-T1-GE3
27	2	Q8, Q9	MOSFET, SMALL SIGNAL SOT23	ON SEMI., 2N7002LT1G
28	1	R1	RES., CHIP., 5.6 $\Omega$ , 0.1W, 5% 0603	VISHAY, CRCW06035R60JNEA
29	2	R2, R18	SENSOR RES 0.008 $\Omega$ 1W 2% 0815 SMD	SUSUMU, RL3720WT-R008-G
30	4	R3, R4, R13, R14	RES., CHIP., 100 $\Omega$ , 0.1W, 5%, 0603	VISHAY, CRCW0603100RJNEA
31	1	R5	RES., CHIP., 15 $\Omega$ , 0.125W, 5% 0805	VISHAY, CRCW080515R0JNEA
32	2	R7, R49	RES., CHIP., 100k, 0.1W, 1% 0603	VISHAY, CRCW0603100KFKEA
33	2	R8, R11	RES., CHIP., 10 $\Omega$ , 0.1W, 5% 0603	VISHAY, CRCW060310R0JNEA
34	2	R9, R10	RES., CHIP., 1.24k, 0.1W, 1% 0603	VISHAY, CRCW06031K24FKEA
35	1	R20	SENSOR RES 0.004 $\Omega$ 1W 2% 0815 SMD	SUSUMU, RL3720WT-R004-G
36	1	R21	RES., CHIP., 121k, 0.1W, 1% 0603	VISHAY, CRCW0603121KFKEA
37	6	R24, R48, R55, R60, RCX, RVM2	RES., CHIP., 10k, 0.1W, 1% 0603	VISHAY, CRCW060310K0FKEA
38	1	R28	RES., CHIP., 5.6 $\Omega$ , 5%, 1206	VISHAY, CRCW12065R60JNEA
39	1	R29	RES., CHIP., 3.6 $\Omega$ , 5%, 1206	VISHAY, CRCW12063R60JNEA
40	2	R44, R58	RES., CHIP., 38.3k, 0.1W, 1% 0603	VISHAY, CRCW060338K3FKEA
41	2	R50, R57	RES., CHIP., 20k, 0.1W, 1% 0603	VISHAY, CRCW060320K0FKEA

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### PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
42	1	R56	RES., CHIP., 68.1k, 0.1W, 1% 0603	VISHAY, CRCW060368K1FKEA
43	1	RC1	RES., CHIP., 14.7k, 0.1W, 1% 0603	VISHAY, CRCW060314K7FKEA
44	1	RCL	RES., CHIP., 24k, 0.1W, 5% 0603	VISHAY, CRCW060324K0JNEA
45	1	RCS	SENSOR RES., 0.01 $\Omega$ 1W 2% 0815 SMD	SUSUMU, RL3720WT-R010-G
46	1	RFB1	RES., CHIP., 154k, 0.1W, 1% 0603	VISHAY, CRCW0603154KFKFA
47	1	RFB2	RES., CHIP., 8.06k, 0.1W, 1% 0603	VISHAY, CRCW06038K06FKFA
48	1	RIFB1	RES., CHIP., 21.5k, 0.1W, 1% 0603	VISHAY, CRCW060321K5FKFA
49	1	RIG	RES., CHIP., 10M, 0.1W, 5% 0603	VISHAY, CRCW060310MJNEA
50	1	RIL	RES., CHIP., 2.00k, 0.1W, 1% 0603	VISHAY, CRCW06032K00FKFA
51	2	RNTC2, RNTC3	THERMISTOR NTC 10k 5% 0603	VISHAY, NTC0603E3103JMT
52	4	ROFB1, RFBF1, R45, R59	RES., CHIP., 1M, 0.1W, 1% 0603	VISHAY, CRCW06031M00FKFA
53	2	ROFB2, RFBF2	RES., CHIP., 84.5k, 0.1W, 1% 0603	VISHAY, CRCW060384K5FKFA
54	1	RVM1	RES., CHIP., 36.5k, 0.1W, 1% 0603	VISHAY, CRCW060336K5FKFA
55	1	U1	I.C., VOLT. REG.	Linear Tech., LTC3789EGN#PBF
56	1	U2	I.C. LTC4000EGN-1, 28 PIN SSOP	Linear Tech., LTC4000EGN-1#PBF
57	2	U3, U4	NANOPWR COMPARATOR, MSOP8	Linear Tech., LTC1540CMS8#PBF

#### DC1721B-B Additional Demo Board Circuit Components

58	0	C3, C23, C26, C27	OPT 1210	
59	1	C33	CAP., X5R, 4.7 $\mu$ F, 10V, 20% 0603	AVX, 0603ZD475MAT2A
60	1	CBAT	CAP., X5R, 2.2 $\mu$ F, 25V, 20% 0805	AVX, 08053D225MAT2A
61	0	CF1, CC1, R6, C7, C8, C11, R12, R22, R27, R30, R38-R43, R53, R61, R62, CNTC, CF, CCX	OPT 0603	OPT
62	2	CIIMON, CIBMON	CAP., COG, 1000pF, 25V, 5% 0603	AVX, 06033A102JAT2A
63	0	CIN3, CIN4	OPT	
64	0	D11	OPT SOD323	OPT
65	1	LED2	LED, DUAL RED/GREEN	LiteOn, LTST-C155KGJRK
66	0	Q10	OPT SOT223	OPT
67	4	R25, R51, R52, R54	RES., 0 $\Omega$ 1/16W 1A 0603	VISHAY, CRCW06030000Z0EA
68	1	R46	RES., CHIP., 2.2k, 0.1W, 5% 0603	VISHAY, CRCW06032K20JNEA
69	1	R47	RES., CHIP., 4.7k, 0.1W, 5% 0603	VISHAY, CRCW06034K70JNEA

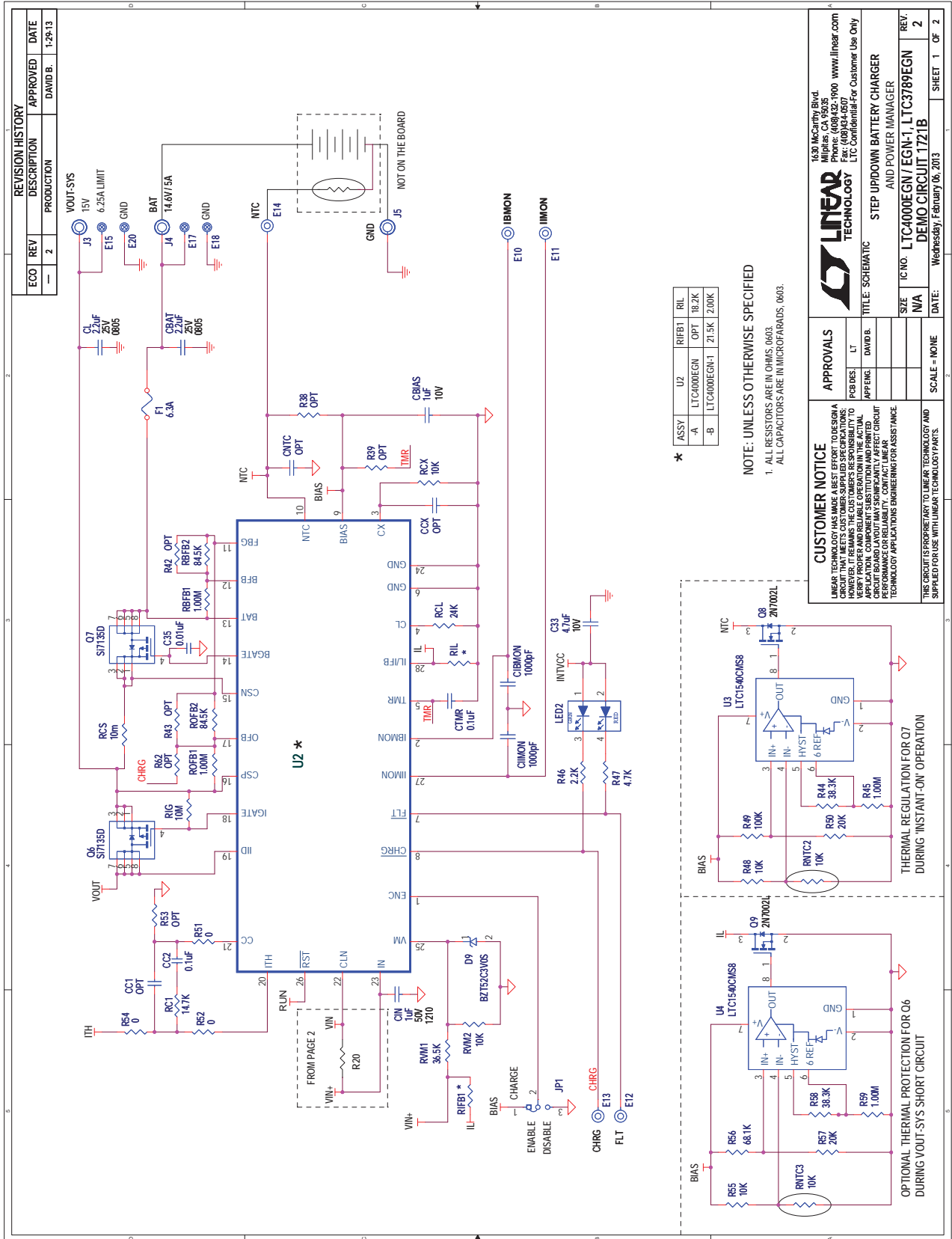
#### DC1721B-B Hardware: For Demo Board Only

70	6	E1, E2, E15, E17, E18, E20	TESTPOINT, TURRET, 0.061" PbF	MILL-MAX, 2308-2-00-80-00-00-07-0
71	12	E3-E14	TESTPOINT, TURRET, 0.094" PbF	MILL-MAX, 2501-2-00-80-00-00-07-0
72	5	J1, J2, J3, J4, J5	CONNECTOR, BANANA JACK	KEYSTONE, 575-4
73	2	JP1, JP2	HEADER, 3 PIN 0.079 SINGLE ROW	SAMTEC, TMM-103-02-L-S
74	4	MH1-MH4	STAND-OFF, NYLON 0.5"	KEYSTONE, 8833 (SNAP ON)
75	2	XJP1, XJP2	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G

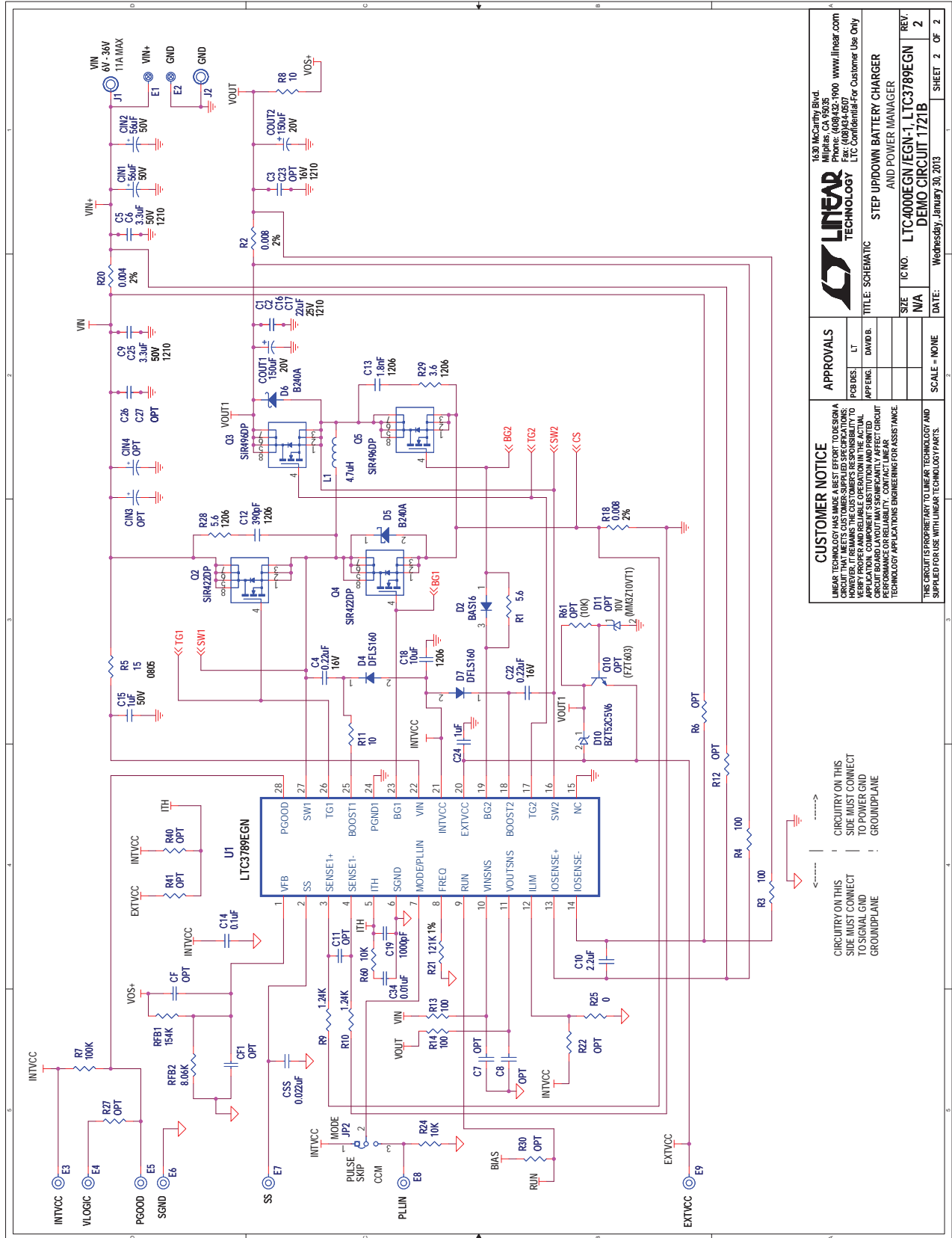
# DEMO MANUAL

## DC1721B-A/DC1721B-B

### SCHEMATIC DIAGRAM



### SCHEMATIC DIAGRAM



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<b>APPROVALS</b> PCB DES: LT APP ENG: DAVID B.	
<b>TITLE: SCHEMATIC</b> STEP UP/DOWN BATTERY CHARGER AND POWER MANAGER	
IC NO:	LTC4000EGN/EGN-1, LTC3789EGN
REV:	2
DATE:	Wednesday, January 30, 2013
SCALE:	N/A
SHEET:	2 OF 2

←-----→  
 CIRCUIRY ON THIS SIDE MUST CONNECT TO SIGNAL GND GROUNDPLANE  
 -----→  
 CIRCUIRY ON THIS SIDE MUST CONNECT TO POWER GND GROUNDPLANE



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# DEMO MANUAL

## DC1721B-A/DC1721B-B

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