DEMO MANUAL DC1685A

LTC6417
LTC6417 and LTC2209
Combo Board

DESCRIPTION

Demonstration circuit 1685A features the LTC®6417, a 1.6GHz differential ADC buffer driving the LTC2209, a 16-bit 160Msps ADC. The DC1685B is supplied with a bandpass filter centered at 140MHz between the buffer and ADC. The filter center frequency can be changed to optimize performance at different analog input frequencies. Both single-ended and differential configurations are supported at the inputs. The DC1685A has been developed from the DC1281A, used to characterize LTC2209 family of ADCs.

Use the DC1685A with a DC890 FastDAACS and PScope™ Software to collect time and frequency data.

Design files for this circuit board are available at http://www.linear.com/demo/DC1685A

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QUICK START PROCEDURE

DC1685A is easy to set up. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Apply power to the DC1685A 3.3V across the pins marked V_{CC} and PWR_GND and 5V across AMP_POWER and PWR_GND. The DC1685A requires up to 800mA from the V_{CC}, and 200mA from the AMP_POWER.
2. Supply power to the DC890B fast DAACS board with an external 6V ±0.5V, 1A on turrets G7(+) and G1(–) or the adjacent 2.1mm power jack. Unless the DC890B detects external power, it will not activate the LVDS mode of the Xilinx Spartan-III FPGA. The FPGA actively terminates the LVDS repeaters at the outputs of the LTC2209.
3. Connect encode clock to the DC1685A on the SMA connector marked (J3) Encode Clock. This transformer coupled input is terminated with a 100Ω at the ADC clock inputs. For best noise performance the clock input must be driven with a very low jitter source. When using a sinusoidal generator, the amplitude should be as large as possible, up to 13dBm. Using bandpass filters on the clock and analog inputs will improve the noise performance by reducing the wideband noise power of the signals. Data sheet FFT plots are taken with 10 pole LC filters made by TTE (Los Angeles, CA) to suppress signal generator harmonics, non-harmonically related spurs and broadband noise. Low phase noise (jitter) Agilent 8644B generators are used with the TTE bandpass filters for the clock and analog input.
4. Connect the analog input to the DC1685A to the SMA connector marked (J6) IN+ at 140MHz. This input is capacitively coupled to a 1:4 balun transformer WBC4-11.
5. Start and configure PScope data collection software for the FastDAACS (DC890) by selecting AutoConfigure. If the board is not detected, update PScope for latest software and device list, and then select LTC2209 from the Configure → Device menu. You can also manually configure PScope for the LTC2209 by setting the parameters listed in Table 1.
6. Collect data by clicking on the Collect button. Time and frequency plots will be displayed in the PScope window. Consult the DC890B Quick Start Guide for more details.

   This procedure contains only one critical sequence. The user must apply supply voltage before applying signal power to the analog and clock inputs or forcing a voltage to any other turrets. The user must also remove the signal to the analog and clock inputs and voltages on any other turret before turning down the supply voltage.

QUICK START PROCEDURE

Table 2 summarizes the function of each SMA connector and jumper on the board and their suggested default settings.

Table 1. PScope User Configuration for LTC2209.

USER CONFIGURE	
Bits	16
Channels	1
Alignment	16
FPGA Ld	LVDS
Bipolar	[x]
Positive Edge Clk	[x]

Table 2. DC1685A Connector and Jumpers

CONNECTOR/ JUMPER	FUNCTION
J2 (MODE)	ADC Output Format and Clock Duty Stabilizer CDS. Default to V_{CC} for twos complement and CDS off.
J3 (SHDN)	ADC Power Shutdown. Default to RUN.
J3 (DITH)	ADC Internal Dither Enable. Default to OFF to disable internal dither.
J4 (PGA)	ADC Programmable Gain Amplifier. Default to 1× gain mode.
J5 (IN–)	Differential Input. Not connected by default. Install capacitor C9 to drive the input differentially.
J6 (IN+)	Differential Input. Connected to input balun for single-ended operation. Drive from a 50Ω signal source. No external termination needed.
J7 (ENCODE CLOCK)	Single-Ended Input. Drive with a 13dBm low jitter 50Ω source.
J11 (OR)	Overrange Output. Connect to an oscilloscope input.

Buffer ADC Interface

The LTC6417 has been specifically designed to interface directly with high speed A/D converters. In Figure 2, the differential LTC6417 outputs are bandpass filtered to drive the differential inputs of the LTC2209. Such a filter suppresses harmonics and limits the wideband noise of the amplifier to achieve the best SFDR and SNR. Table 3 lists component values suggested for bandpass filters optimized for various input frequencies. The 1:4 transformer at the input of the LTC6417 performs a single-ended to differential conversion and provides 6dB voltage gain.

For more detail on the LTC6417 and LTC2209, consult the data sheets.

Table 3. Bandpass Filter Component Values for Various Input Frequencies

	INPUT FREQUENCIES			
COMPONENTS	70MHz	140MHz	270MHz	380MHz
R12 = R36 [Ω]	60.4	60.4	60.4	60.4
C43 = C44 [pF]	56	27	15	12
E1 = E2 [nH]	100	51	27	18
C41 [pF]	47	12	12	10
C10 = C40 [pF]	13	12	33	2.7
E5 [nH]	100	51	27	18
R42 = R43 [Ω]	300	300	300	300
R53 [Ω]	120	120	120	120
C45 = C46 [pF]	39	18	10	8.2
E3 = E4 [nH]	150	75	39	27

PCB LAYOUT

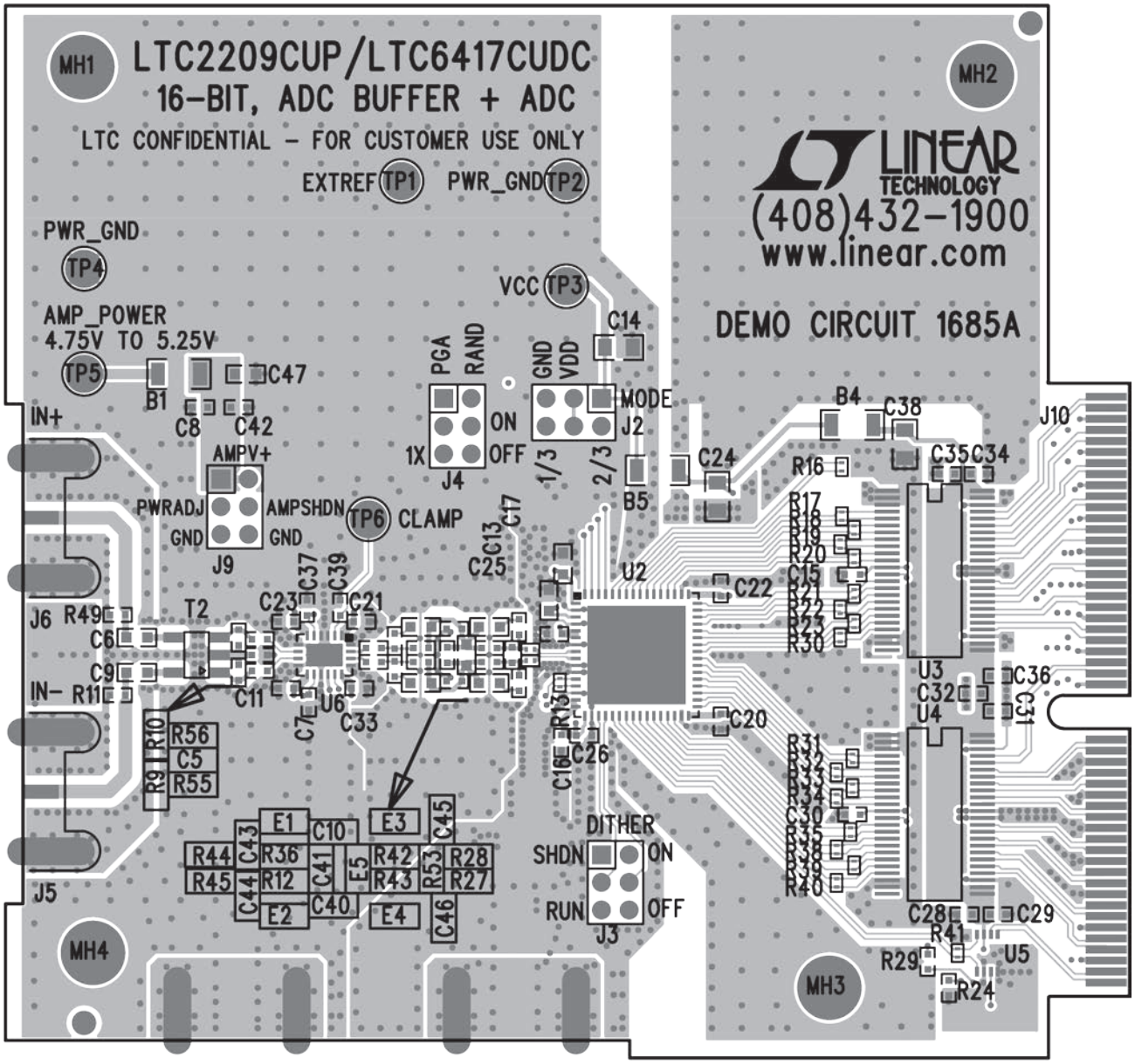

Figure 1. DC1685A Layout

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	3	B1, B4, B5	Ferrite Bead, SMT 1206	MURATA, BLM31PG330SN1L
2	3	C1, C2, C3	Cap., X7R 0.01µF 100V 10% 0603	AVX, 06031C103KAT2A
3	1	C4	Cap., NPO 8.2pF 50V 0.25pF 0402	AVX, 04025A8R2CAT2A
4	26	C5, C7, C8, C11, C12, C15, C16, C20–C23, C25–C37, C39, C42	Cap., X5R 0.1µF 10V 10% 0402	AVX, 0402ZD104KAT2A
5	3	C6, C9, C48	Cap., X7R 0.1µF 25V 10% 0603	AVX, 06033C104KAT2A
6	3	C10, C40, C41	Cap., X7R 12pF 25V 10% 0402	AVX, 04023C120KAT2A
7	2	C13, C17	Cap., X5R 2.2µF 10V 20% 0603	AVX, 0603ZD225MAT2A
8	3	C14, C24, C38	Cap., X5R 4.7µF 10V 20% 0805	AVX, 0805ZD475MAT2A
9	0	C18, C19 (OPT)	Cap., 0402, OPT	
10				
11	2	C43, C44	Cap., NPO 27pF 25V 10% 0402	AVX, 04023A270KAT2A
12	2	C45, C46	Cap., NPO 18pF 25V 10% 0402	AVX, 04023A180KAT2A
13	0	C47, C49 (OPT)	Cap., 0603 OPT	
14	3	E1, E2, E5	Ceramic Chip Inductor, 51nH, 0603	Coilcraft, 0603HP_51NXGLU
15	2	E3, E4	Ceramic Chip Inductor, 75nH, 0603	Coilcraft, 0603HP_75NXGLU
16				
17	4	J2, J3, J4, J9	Headers, Dbl. Row 2 × 3 2mm Ctrs.	Samtec, TMM-103-02-L-D
18	5	XJ2, XJ3_3-5, XJ3_4-6, XJ4_3-5, XJ4_4-6	Shunt, 2mm Ctrs.	Samtec, 2SN-BK-G
19	4	J5, J6, J7, J11	Conn., SMA 50Ω	EMERSON, 142-0701-851
20	0	J10	EDGE-CON-100	
21	4	R1, R2, R9, R10	Res., Chip 49.9Ω 0.06W 1% 0402	YAGEO, RC0402FR-0749R9L
22	0	R3 (OPT)	Res., 0603 OPT	
23	2	R4, R5	Res., Chip 5.11Ω 0.06W 1% 0402	VISHAY, CRCW04025R11FKED
24	3	R6, R7, R8	Res., Chip 1.00k 0.06W 1% 0603	YAGEO, RC0603FR-071KL
25	5	R11, R44, R45, R55, R56	Res., Chip 0Ω 0402	VISHAY, CRCW04020000Z0ED
26	1	R12	Res., Chip 82Ω 0.06W 1% 0402	Vishay, CRCW040282R0FKED
27	19	R13, R16–R23, R30–R35, R38–R41	Res., Chip 100Ω 0.05W 5% 0201	YAGEO, RC0201JR-07100RL
28	1	R14	Res., Chip 1.00k 0.06W 1% 0402	YAGEO, RC0402FR-071KL
29	1	R15	Res., Chip 100Ω 0.06W 5% 0402	VISHAY, CRCW0402100RFKED
30	1	R24	Res., Chip 100k 0.06W 5% 0402	VISHAY, CRCW0402100KJNED
31	3	R25, R26, R29	Res., Chip 4.99k 0.06W 1% 0402	VISHAY, CRCW04024K99FKED
32	2	R27, R28	Res., Chip 10Ω 0.05W 5% 0201	VISHAY, CRCW020110R0JNED
33	1	R36	Res., Chip 60.4Ω 0.06W 1% 0402	VISHAY, CRCW040260R4FKED
34	1	R37	Res., Chip 100Ω 0.06W 1% 0603	Vishay, CRCW0603100RFKEA
35	2	R42,R43	Res., Chip 300Ω 0.06W 5% 0402	NIC, NRC04F3000TRF
36	0	R49 (OPT)	Res., 0402 OPT	
37	1	R53	Res., Chip 120Ω 0.06W 5% 0402	YAGEO, RC0402JR-07120RL
38	6	TP1, TP2, TP4, TP5, TP6, TP7	Turret, Testpoint	Mill Max, 2308-2-00-80-00-00-07-0
39	1	T2	XFMR 1 : 4	COILCRAFT, WBC4-14LB
40	1	T3	XFMR MACOM/SM-22	M/A-COM, MABA-007159-000000

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
41	1	U1	I.C., Serial EEPROM TSSOP-8	MICROCHIP, 24LC025-I/ST
42	1	U2	I.C., 16-Bit, 160Msps ADC QFN(64) (UP) 9mm × 9mm	Linear Tech., LTC2209CUP#PBF
43	2	U3, U4	I.C., LVDS 8-Port, Hi speed Repeater TSSOP48 6.1mm Wide	FAIRCHILD, FIN1108MTD
44	1	U5	I.C. BUFFER-LVDS-SINGLE US8	FAIRCHILD, FIN1101K8X
45	1	U6	I.C., ADC Buffer QFN(20) (UDC) 3mm × 4mm	Linear Tech., LTC6417CUDC#PBF
46	4	MTGS at 4 Corners	STANDOFF, NYLON .5 1/2"	KEYSTONE, 8833(SNAP-ON)

SCHEMATIC DIAGRAM

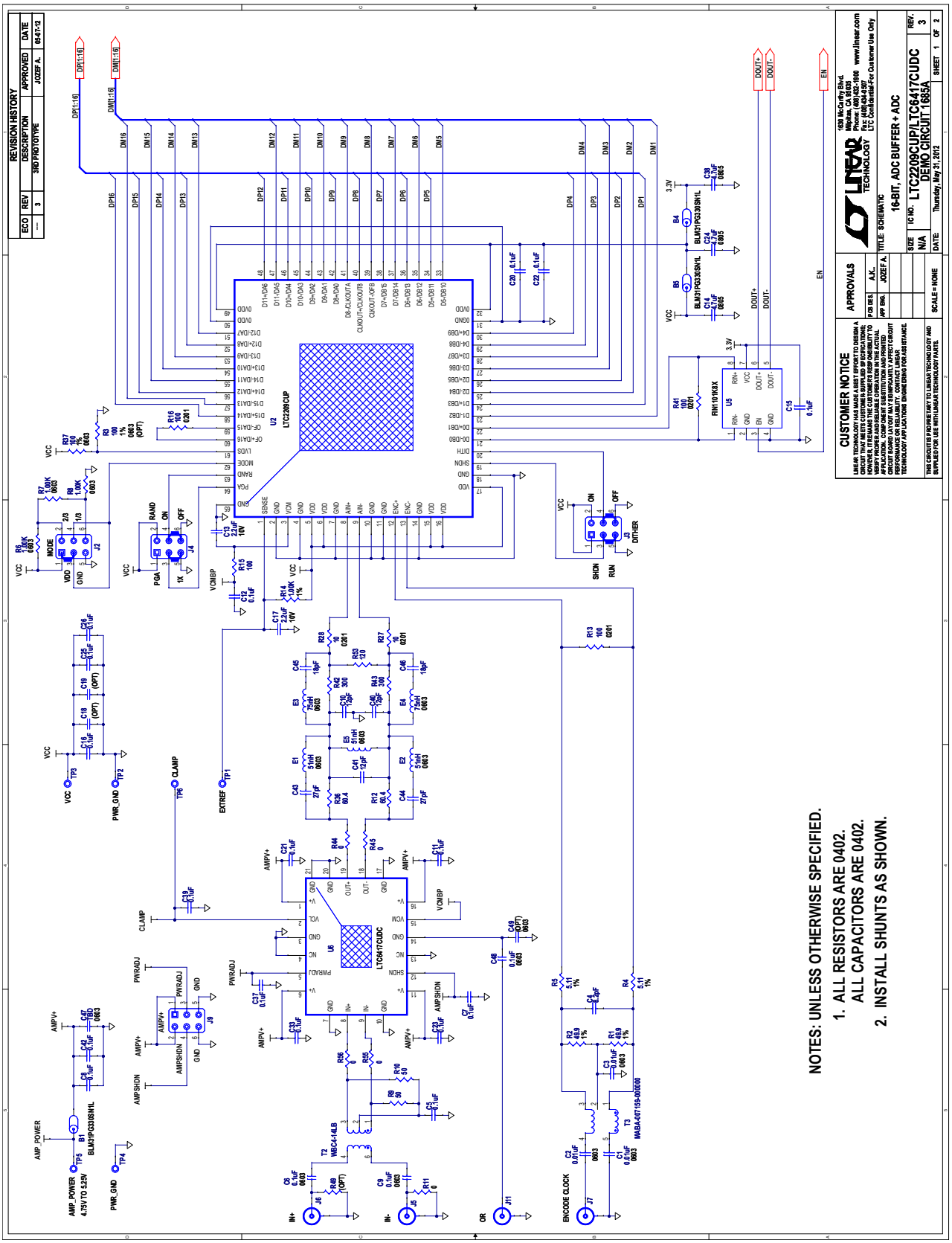

Figure 2a. DC1685A Demo Circuit Schematic

SCHEMATIC DIAGRAM

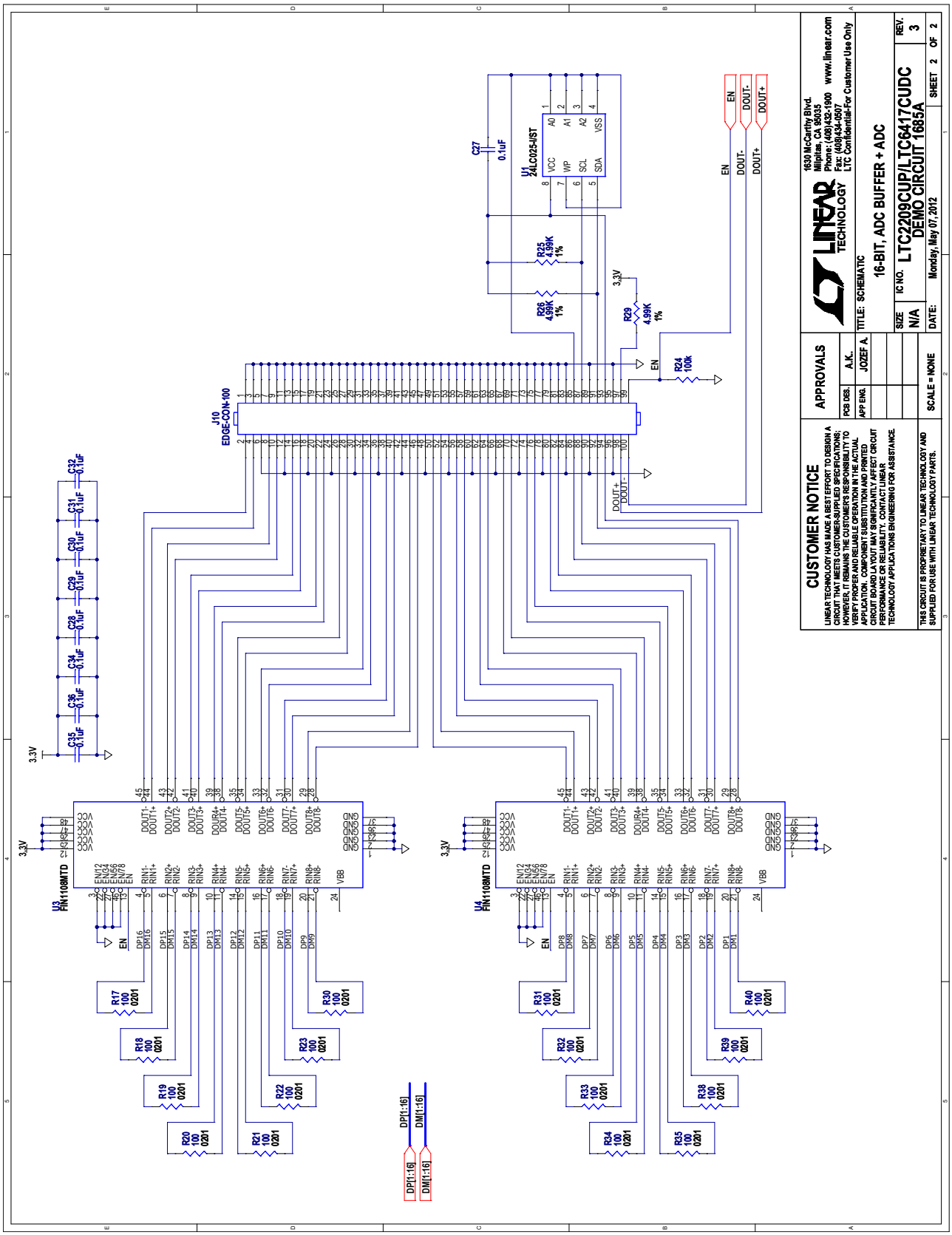

Figure 2b. DC1685A Demo Circuit Schematic

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