LTM9004
14-Bit Direct Conversion Receiver Subsystem

DESCRIPTION

Demonstration circuit 1513 is an evaluation board featuring Linear Technology Corporation's LTM®9004 14-bit direct conversion receiver subsystem. DC1513 demonstrates good circuit layout techniques and recommended external circuitry for optimal system performance.

DC1513 comes with Linear Technology's 14-bit LTM9004 receiver subsystem installed. The board includes output CMOS buffers. DC1513 plugs into the DC890 data acquisition demo board and the output can be easily analyzed with Linear Technology's PScope™ data processing software, which is available for no charge on our website at http://www.linear.com/software.

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

Table 1. DC1513B Variants

DC1513B VARIANTS	RESOLUTION	MAXIMUM SAMPLE RATE	BASEBAND BANDWIDTH
1513B-AA	14-Bit	125Msps	DC - 1.92MHz
1513B-AB	14-Bit	125Msps	DC - 4.42MHz
1513B-AC	14-Bit	125Msps	DC - 9.42MHz
1513B-AD	14-Bit	125Msps	DC - 20MHz

QUICK START PROCEDURE

Validating the performance of the LTM9004 is simple with DC1513, and requires only two input sources, a clock source, a computer, and a lab power supply. Refer to Figure 1 for proper board evaluation equipment setup and follow the procedure below:

1. Connect the power supply as shown in Figure 1. There are onboard low noise voltage regulators that provide the two supply voltages for the DC1513. The entire board and all components share a common ground. The power supply should still be a low noise lab power supply capable of supplying at least 0.5A at 5VDC, and 1A at 3VDC.
2. Provide an encode clock to the ADC via SMA connector J7. Use a low-phase-noise clock source such as a filtered RF signal generator or a high quality clock oscillator.

   NOTE: Similar to having a noisy input, a high jitter (phase noise) encode clock will degrade the signal-to-noise ratio (SNR) of the system.

Table 2. DC1513 Connectors and Jumpers

REFERENCE	FUNCTION
J3 (SHDN)	Enables/Disables the ADC. Default Is ON.
J4 (MODE)	Output Format and Clock Duty Stabilizer Pin. Default Is VDD.
J5 (SHDN_AMP)	Enables/Disables the Amplifiers. Default Is ON.
J6 (LO)	Board LO Signal Input. Impedance Matched to 50Ω for Use with Lab Signal Generators.
J7 (CLK)	Board Clock Input. Impedance Matched to 50Ω. Drive with a Low-Phase-Noise Clock Oscillator or Filtered Sine Wave Signal Source.
J8 (MIXER ENABLE)	Enables/Disables the RF Mixer. Default Is ON.
J11 (RF)	Board RF Signal Input. Impedance Matched to 50Ω for Use with Lab Signal Generators.
TP1 (SENSE_I)	Reference Input to Adjust the Full-Scale Range of the DC1513, I-Channel. Default Is VDD.
TP2 (GND)	DC Ground.
TP4 (GND)	DC Ground.
TP5 (3V)	DC Supply Input (3VDC).
TP7 (5V)	DC Supply Input (5VDC).
TP8 (GND)	DC Ground.
TP12 (SENSE_Q)	Reference Input to Adjust the Full-Scale Range of the DC1513, Q-Channel. Default Is VDD.

QUICK START PROCEDURE

3. Apply an RF input signal to the board. For best results, use a low distortion, low noise signal generator with sufficient filtering to avoid degrading the performance of the receiver.
4. Apply an LO input signal to the board. Note that the difference in frequency between this signal and the RF signal will be the IF frequency resulting at the IF filter and ADC input.
5. Observe the ADC output with demo circuit DC890B, a USB cable, a Windows computer, and Linear Technology's PScope data processing software.

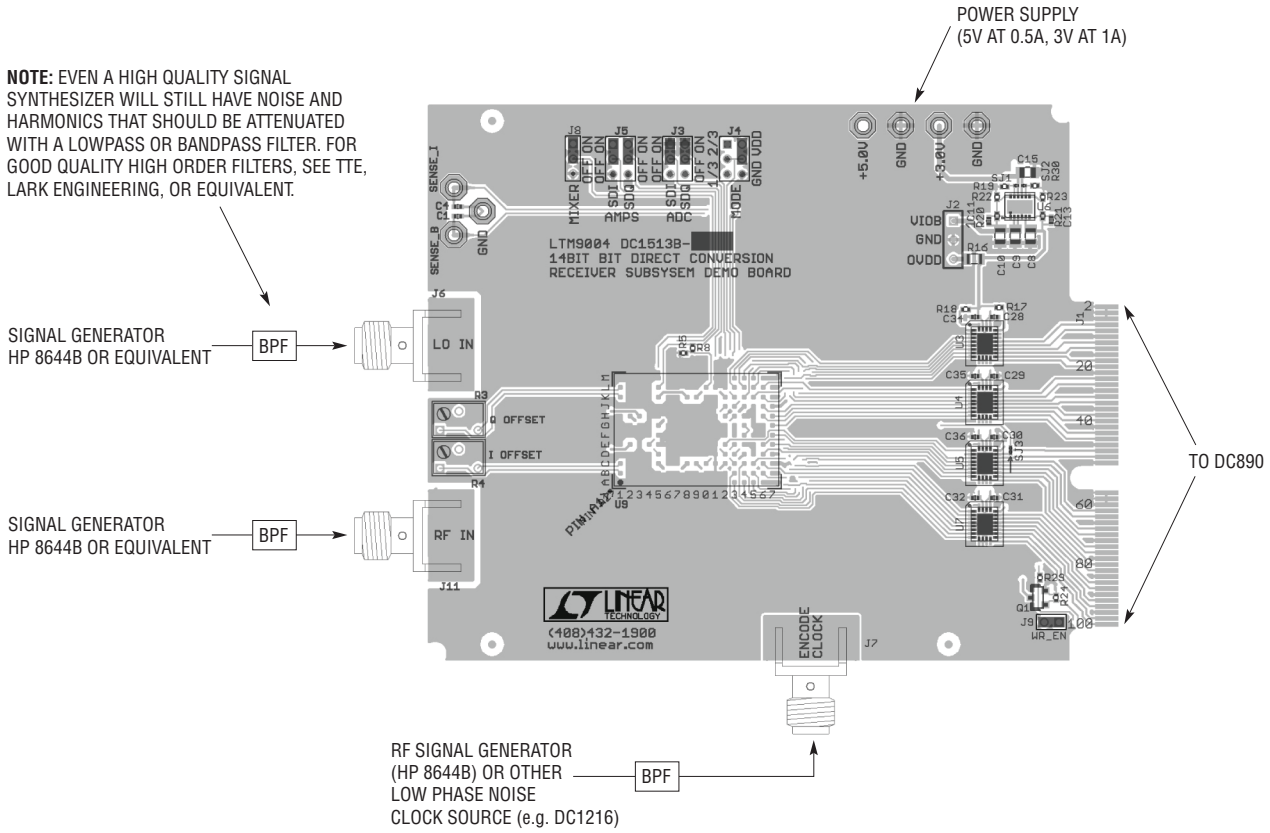


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

OTHER BOARD CIRCUITRY

Device U1 is an EEPROM device that is used by the PScope software to identify the board and apply the correct settings for the data collection.

USING PSCOPE SOFTWARE

PScope, downloadable from Linear Technology's website http://www.linear.com/, processes data from the DC890 data acquisition board and displays FFT and signal analysis information on the computer screen.

The onboard EEPROM U1 should enable automatic board detection and auto configuration of the software, but if the user wishes to change the settings, they can easily do so.

From the configure menu in the toolbar, uncheck autodetect device. The default settings for DC1513 are shown in Figure 2.

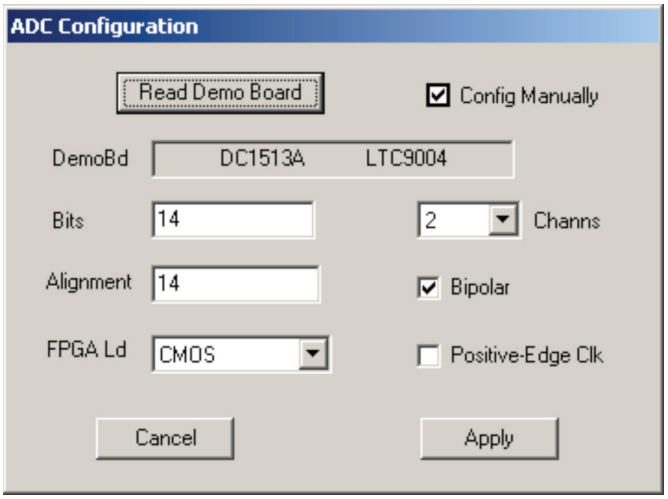


Figure 2. Entering the Correct Device Information for Your ADC. Select the Correct Parameters for the DC1513. Under Normal Conditions, PScope Should Automatically Recognize the Board and Adjust the Software Settings Accordingly.

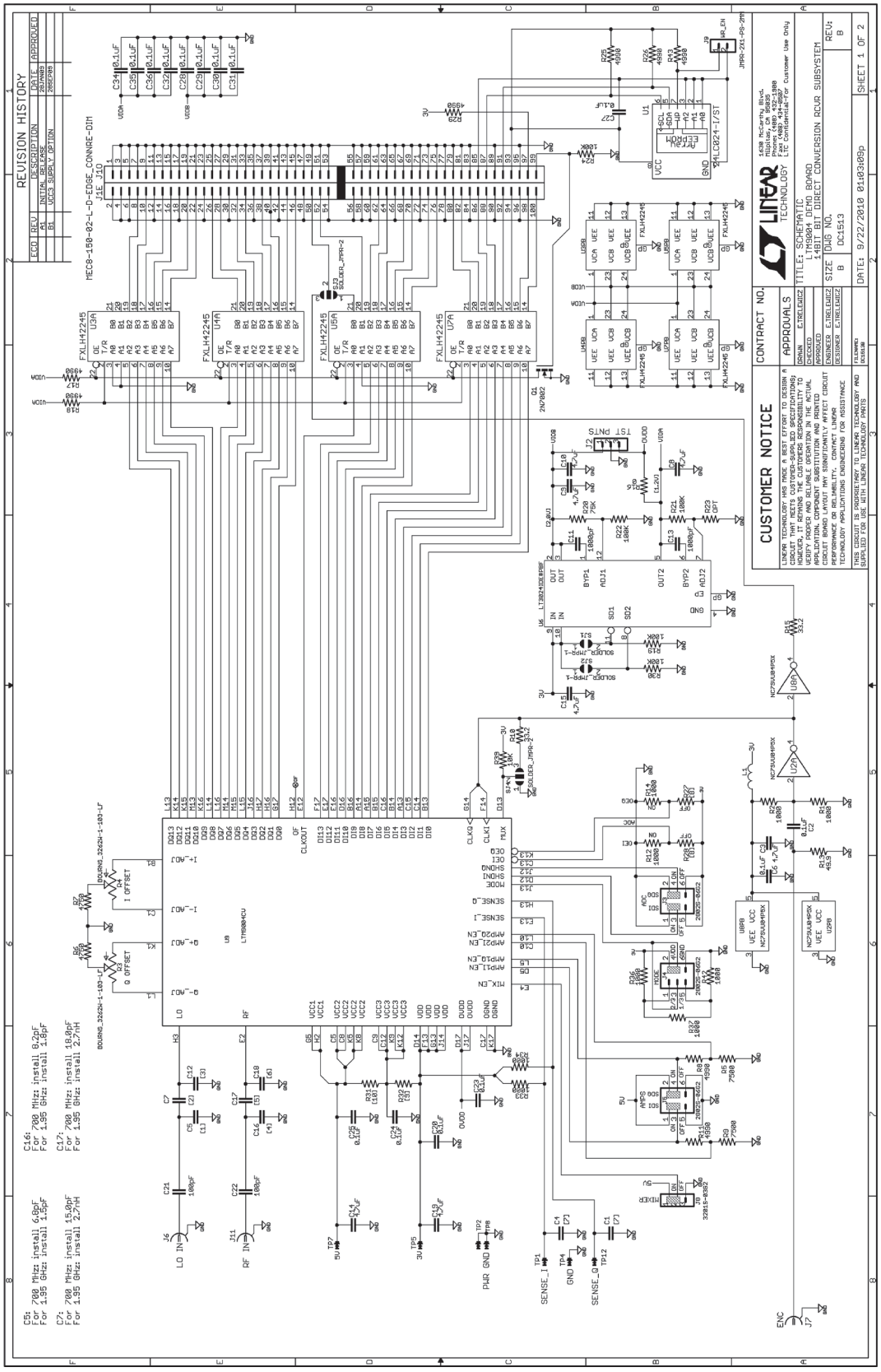
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC1513B				
1	2	C11, C13	CAP, X7R, 1000pF, 16V, 10%, 0402	AVX 0402YC102KAT
2	13	C2, C6, C24, C25, C27 TO C32, C34, C35, C36	CAP, 0402 0.1µF 10% 10V X5R	AVX 0402ZD104KAT2A
3	2	C20, C23	CAP, X7R, 0.1µF, 16V, 10%, 0603	AVX 0603YC104KAT
4	2	C21, C22	CAP, NPO, 100pF, 50V, 5%, 0402	AVX 04025A101JAT2A
5	7	C3, C8 TO C10, C14, C15, C19	CAP, 0805 4.7µF 20% 25V X7R	TAIYO YUDEN TMK212BJ475MG-T
6	0	C1, C4, C5, C12, C16, C18	CAP, 0402, DNI	
7	2	C7, C17	CAP, NPO, 10pF, 50V, 5%, 0402	AVX 04025A100JAT2A
8	3	J3, J4, J5	HEADER, 3 × 2 PIN, 2mm	SAMTEC TMM-103-02-L-D
9	3	J6, J7, J11	CONN, SMA 50Ω EDGE-LANCH	E.F. JOHNSON, 142-0701-851
10	1	J8	HEADER, 3 × 1 PIN, 2mm	SAMTEC TMM-103-02-L-S
11	1	J9	HEADER, 2 × 1 PIN, 2mm	SAMTEC TMM-102-02-L-S
12	7	JP1 TO JP7	SHUNT	SAMTEC, 2SN-BK-G
13	1	L1	FERRITE BEAD, 60Ω, 0603	MURATA BLM18PG600SN1D
14	1	Q1	XSTR, MOSFET, SOT23	DIODES/ZETEX 2N7002-7-F
15	9	R1, R2, R12, R14, R33, R34	RES, 0402 1k 1% 1/16W	NIC NRC04F1001TRF
16	2	R36, R37, R42, R10, R15	RES, 0402 33.2Ω 1% 1/16W	NIC NRC04F33R2TRF
17	1	R13	RES, 0402 49.9Ω 1% 1/16W	NIC NRC04F49R9TRF
18	1	R16	RES, 0805 0Ω JUMPER	VISHAY CRCW08050000Z0EA
19	5	R19, R21, R22, R24, R30	RES, 0402 100k 1% 1/16W	VISHAY CRCW0402100KFKED
20	1	R20	RES, 0402 75k 1% 1/16W	VISHAY CRCW040275K0FKED
21	0	R23, R27, R28	RES, 0402, DNI	
22	2	R3, R4	POT, 10k, TOP ADJUSTMENT, THROUGH HOLE	BOURNS 3262W-1-103LF
23	1	R39	RES, 0402 10k 1% 1/16W	VISHAY CRCW040210K0FKED
24	2	R6, R7	RES, 0402 4.75k 1% 1/16W	VISHAY CRCW04024K75FKED
25	8	R8, R11, R17, R18, R25, R26, R29, R43	RES, 0402 4.99k 1% 1/16W	VISHAY CRCW04024K99FKED
26	7	TP1, TP2, TP4, TP5, TP7, TP8, TP12	TURRET	MILL-MAX, 2308-2-00-80-00-00-07-0
27	1	U1	IC, SERIAL EEPROM, TSSOP	MICROCHIP 24LC025-I/ST
28	2	U2, U8	IC, LOGIC, INV, UNBUFFERED SC70	FAIRCHILD NC7SVU04P5X
29	4	U3, U4, U5, U7	IC, BUS BUF LVL XLATE CMOS, OCTAL, DFN 8mm × 4mm	FAIRCHILD FXLH42245MPX
30	1	U6	IC, DFN12, VREG, DUAL, 500MA, 100MA	LINEAR TECHNOLOGY LT3024IDE#PBF
31	4		HW, SPACER, NYLON, 0.25"	KEYSTONE 8831
DC1513B-AA				
1	1	DC1513B	GENERAL BOM	
2	1	R31	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
3	0	R32	RES, 0603 DNI	
4	0	R5, R9	RES, 0402 DNI	
5	1	U9	LTM9004CV-AA	LINEAR TECHNOLOGY LTM9004CV-AA#PBF
6	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1513B

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC1513B-AB				
1	1	DC1513B	GENERAL BOM	
2	1	R31	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
3	0	R32	RES, 0603 DNI	
4	0	R5, R9	RES, 0402 DNI	
5	1	U9	LTM9004CV-AB	LINEAR TECHNOLOGY LTM9004CV-AB#PBF
6	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1513B
DC1513B-AC				
1	1	DC1513B	GENERAL BOM	
2	0	R31	RES, 0603 DNI	
3	1	R32	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
4	2	R5, R9	RES, 0402 7.5k 1% 1/16W	VISHAY CRCW04027K50FKED
5	1	U9	LTM9004CV-AC	LINEAR TECHNOLOGY LTM9004CV-AC#PBF
6	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1513B
DC1513B-AD				
1	1	DC1513B	GENERAL BOM	
2	0	R31	RES, 0603 DNI	
3	1	R32	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
4	2	R5, R9	RES, 0402 7.5k 1% 1/16W	VISHAY CRCW04027K50FKED
5	1	U9	LTM9004CV-AD	LINEAR TECHNOLOGY LTM9004CV-AD#PBF
6	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1513B

SCHEMATIC DIAGRAM



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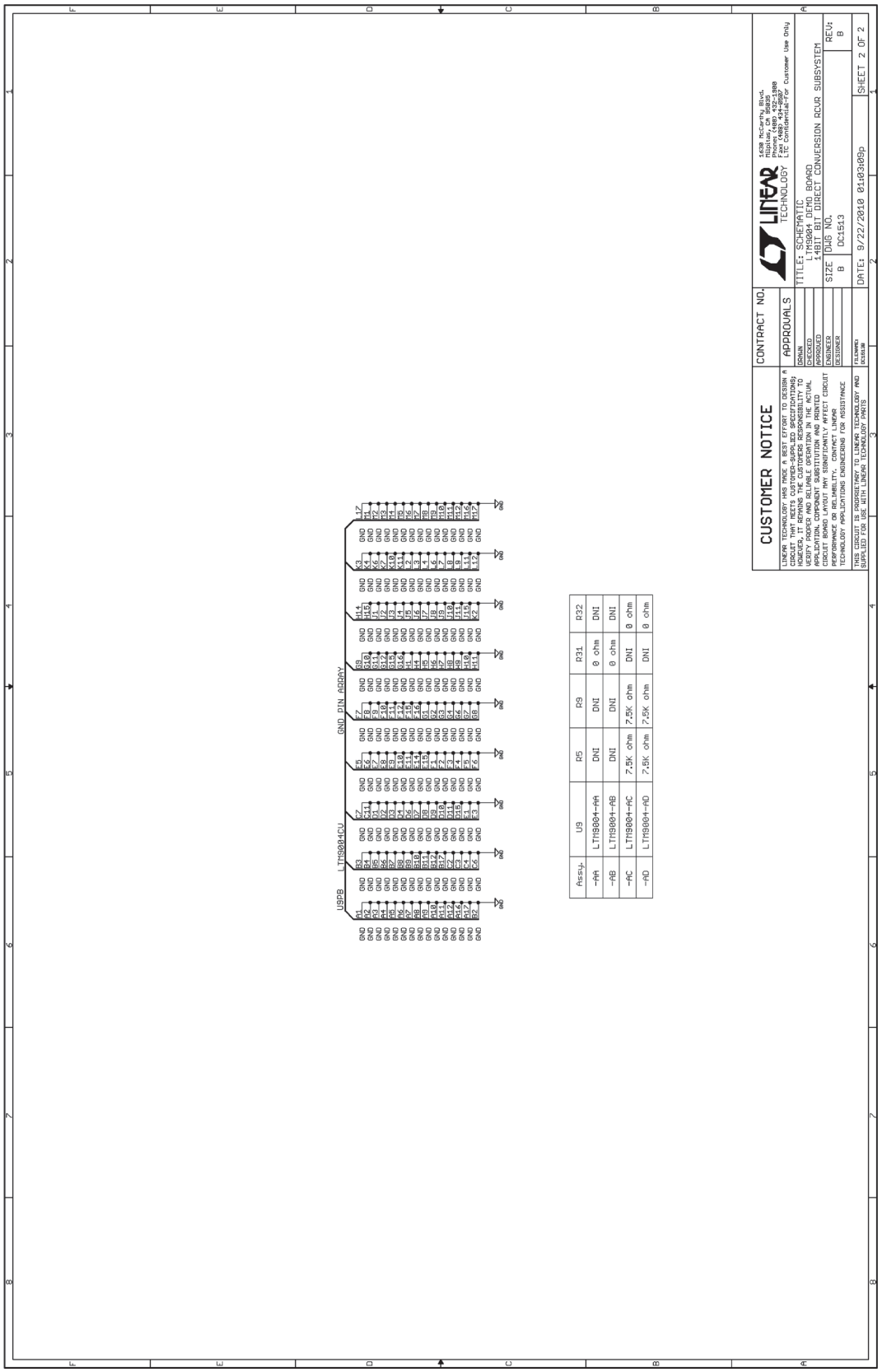

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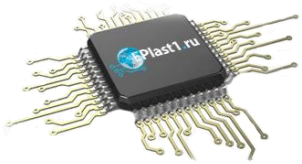

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