ADC12EU050: Ultra-low Power, Octal, 12-bit, 45MSPS Sigma-Delta Analog-to-Digital Converter

This Evaluation Board is used to evaluate one of the A/D Converter ADC12EU050. The ADC is a 12 bit converter that provides data at a rate of 45 MHz.

The evaluation board is designed to be used with the WaveVision5™ Data Capture Board which is connected to a personal computer through a USB port and running WaveVision5™ software, operating under Microsoft Windows. The software can perform an FFT on the captured data upon command and, in addition to a frequency domain plot, shows dynamic performance in the form of SNR, SINAD, THD SFDR and ENOB.

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1 Board Assembly

The ADC12EU050 Evaluation Board comes pre-assembled. Refer to the Bill of Materials in Section 7 for a description of components, to Figure 1 for major component placement and to Section 5 for the Evaluation Board schematic.

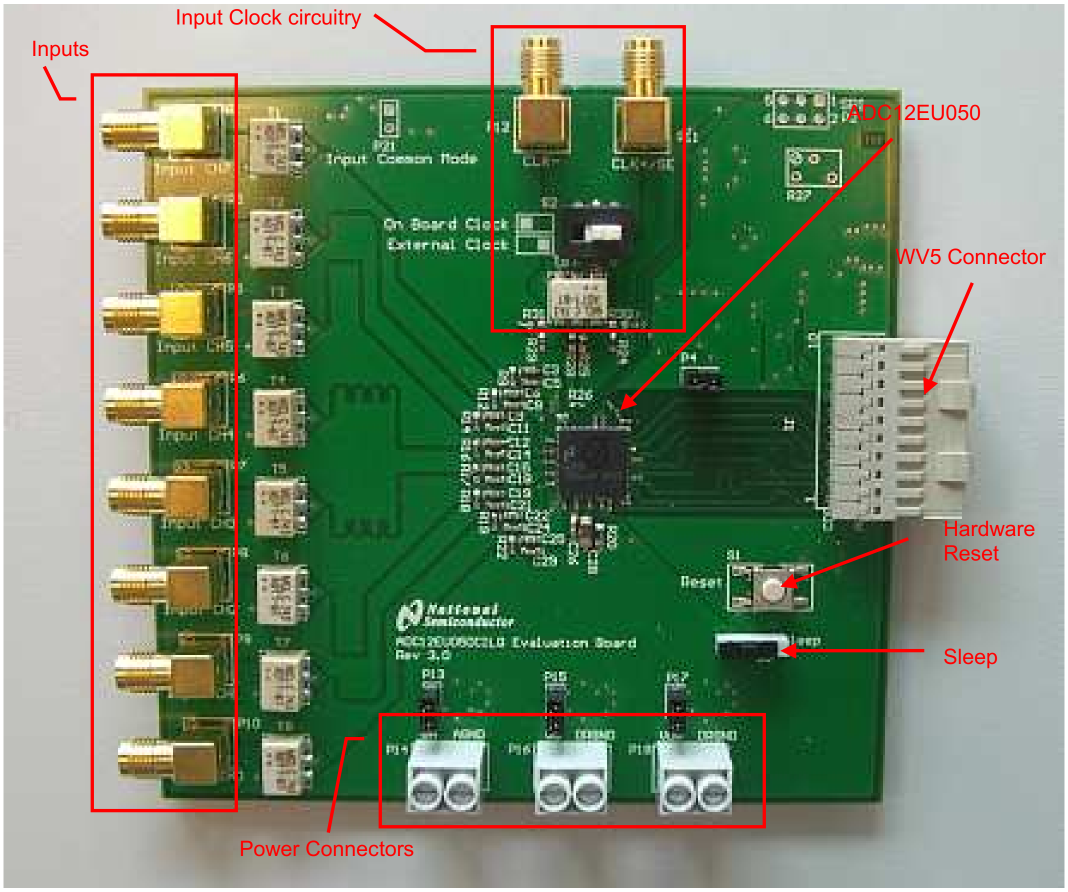

Figure 1. Major Component Locations

2 Quick Start

Refer to Figure 1 for locations of jumpers, test points and major components. The board is configured by default to use an on board crystal clock source and internal reference. Refer to Section 3 for detailed information on jumper settings.

You must have the WaveVision5™ software to test this board. You can download the latest version from the Texas Instruments website.

1. Connect the ADC12EU050 evaluation board to the WaveVision5™ Data Capture Board.
2. Apply power to the WaveVision5™ Data Capture Board.
3. Connect power to the ADC12EU050 board as described in Section 3.4, and power it up.
4. Connect the WaveVision5™ board to the computer using a USB cable.
5. Start the WaveVision5™ software.
6. Connect a signal from a 50-Ω source to connector a channel input. Be sure to use a bandpass filter before the Evaluation Board.
7. Adjust the input signal amplitude as needed to ensure that the signal does not over-range by examining an FFT of the output data with the WaveVision™ software.

3 Functional Description

The ADC12EU050 Evaluation Board schematic is shown in Section 5. A list of default switch and jumper settings can be found in Section 3.8.

3.1 Analog Input

The analog input is supplied through standard SMA connectors. The evaluation board is designed for single ended inputs, which are converted to differential by the transformers.

It must be ensured that a high quality signal source is used so that the ADC dynamic performance can be properly evaluated. A bandpass filter on the input signal is highly recommended.

3.2 ADC Reference

The ADC12EU050 can use an internal or external reference. This evaluation board is configured to use the internal reference.

3.3 ADC Input Clock

The ADC12EU050 can only be clocked at 45MHz. The input clock circuit is shown in Figure 2.

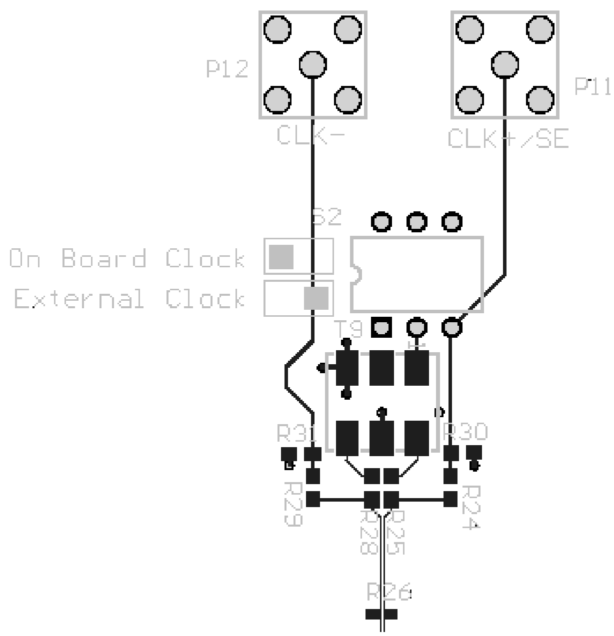

Figure 2. Input clock circuit

Select “External Clock” with switch S2 which disables the on-board crystal oscillator. It enables the user to connect a single ended clock to P11. This clock is converted to a differential signal by the transformer T9.

Selecting “On Board Clock” with switch S2 is not supported unless a 45MHz Crystal Oscillator is populated at IC1.

The external clock amplitude and waveform are fairly flexible, but a 600mVpp differential square wave at the chip inputs is recommended.

By changing the 0 ohm resistors R24, R25, R28 and R29 other clock input configurations can be realized. For example, a fully differential clock could be supplied, bypassing the on-board transformer.

If a single ended clock is supplied to the ADC, then the LVDS termination resistor, R26, must be removed.

3.4 Power Supply Connections

Power to the board is supplied through the power connectors P14, P16 and P18. The required voltages are shown in Figure 3 and described underneath.

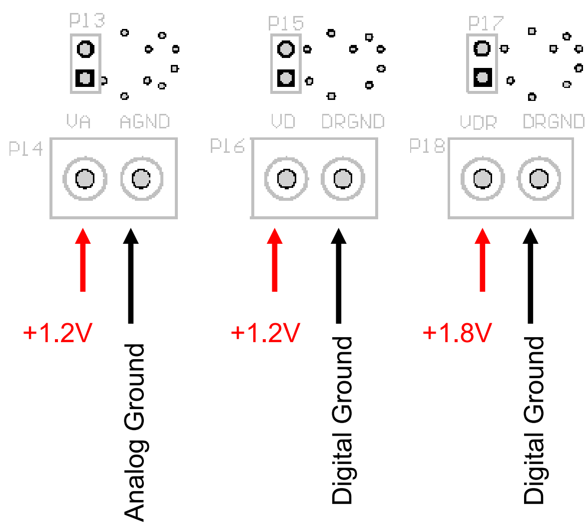

Figure 3. Power Supply Connections

P14: Analog power and ground

- ADC12EU050 analog supply, VA.
- Connect VA to 1.2V, AGND to ground
- Current can be measured across P13

P16: Digital power and ground

- ADC12EU050 digital supply, VD
- Connect VD to 1.2V, DRGND to ground
- Current can be measured across P15

P18: Output driver power and ground

- ADC12EU050 output driver supply, VDR
- Connect VDR to 1.8V, DRGND to ground (same as DRGND of P16)
- Current can be measured across P17

Generally, all grounds can be tied together, as can analog and digital supplies (VA and VD).

The data sheet for the ADC12EU050 specifies that the output driver supply voltage (VDR) can be 1.2V or 1.8V. Due to the design of the evaluation system, specifically the distance from the ADC12EU050 to the Xilinx Virtex4 FPGA on the WaveVision5™ board and the connector through which the LVDS outputs are routed, VDR should be kept at 1.8V.

A VDR of 1.2V can be used, but in this case the LVDS current drive (I_drive, SPI register 0x18, bits 3:2) must be increased to 5mA.

3.5 Reset

The reset button pulls the RSTb pin of the ADC12EU050 low, resetting the ADC. The reset button only affects the ADC, not any other component on the board, or on the WaveVision5™ board.

3.6 Sleep

The sleep switch puts the ADC input sleep mode, by connecting the SLEEP pin to VDR.

3.7 Input Common Mode

Jumper P21 can be used to force a common mode on the ADC inputs. In its default configuration, the evaluation board has capacitively coupled ADC inputs, and using the Input Common Mode jumper will not have any effect.

3.8 Default Jumper and Switch Settings

On delivery, the board's jumpers and switches should be set as defined in Table 1. Any directions are defined when the board is positioned as in Figure 1.

Table 1. Board Jumpers and Switches

Jumper or Switch	Default Position
P2	Open
P4	Closed
P13	Closed
P15	Closed
P17	Closed
P21	Open
S2	Left (On Board Clock)
S3	Left (Sleep mode not active)

4 Software and SPI Registers

The ADC12EU050 evaluation board is designed to be used with the WaveVision5™ data capture board and software. The latest version of the WaveVision5™ software must be used.

4.1 SPI Registers

As described in the ADC12EU050 datasheet, there are many user registers accessible via the SPI interface.

These registers can all be programmed via the "Registers" tab in the WaveVision5™ software.

All registers and values are described in the ADC12EU050 data sheet, which is available from the Texas Instruments website.

5 Hardware Schematics

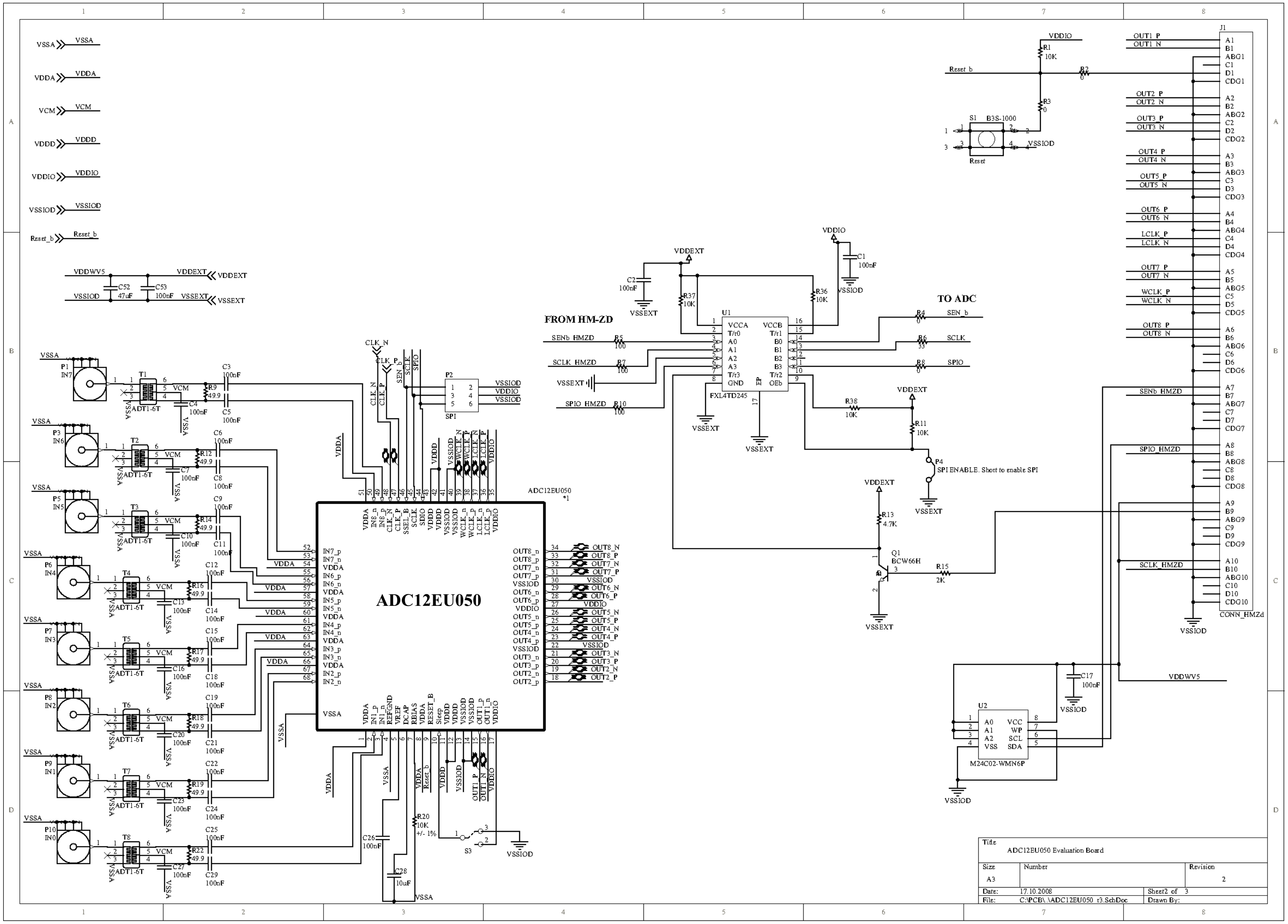

Figure 4. Schematic - 1 of 3

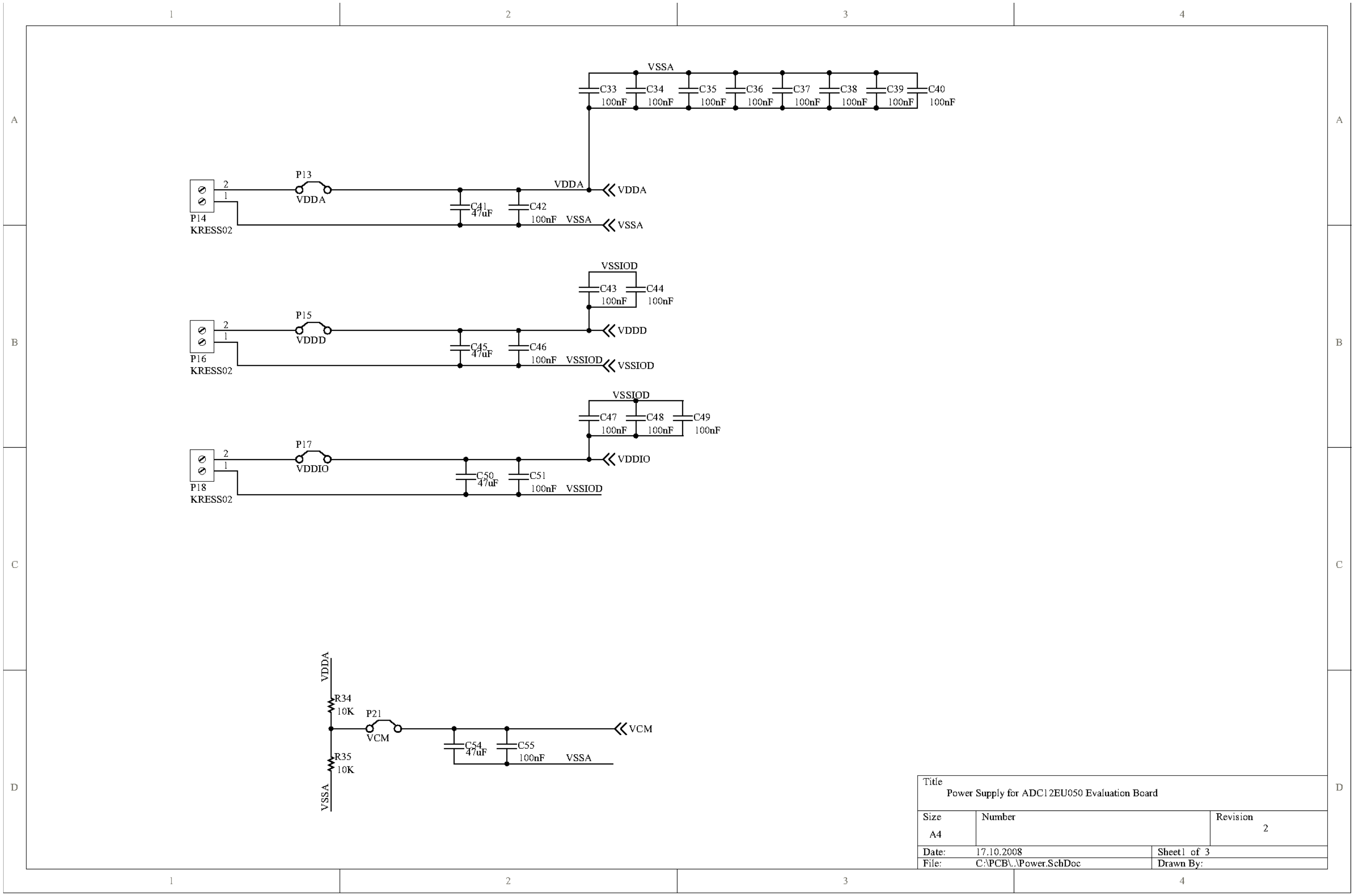

Figure 5. Schematic - 2 of 3

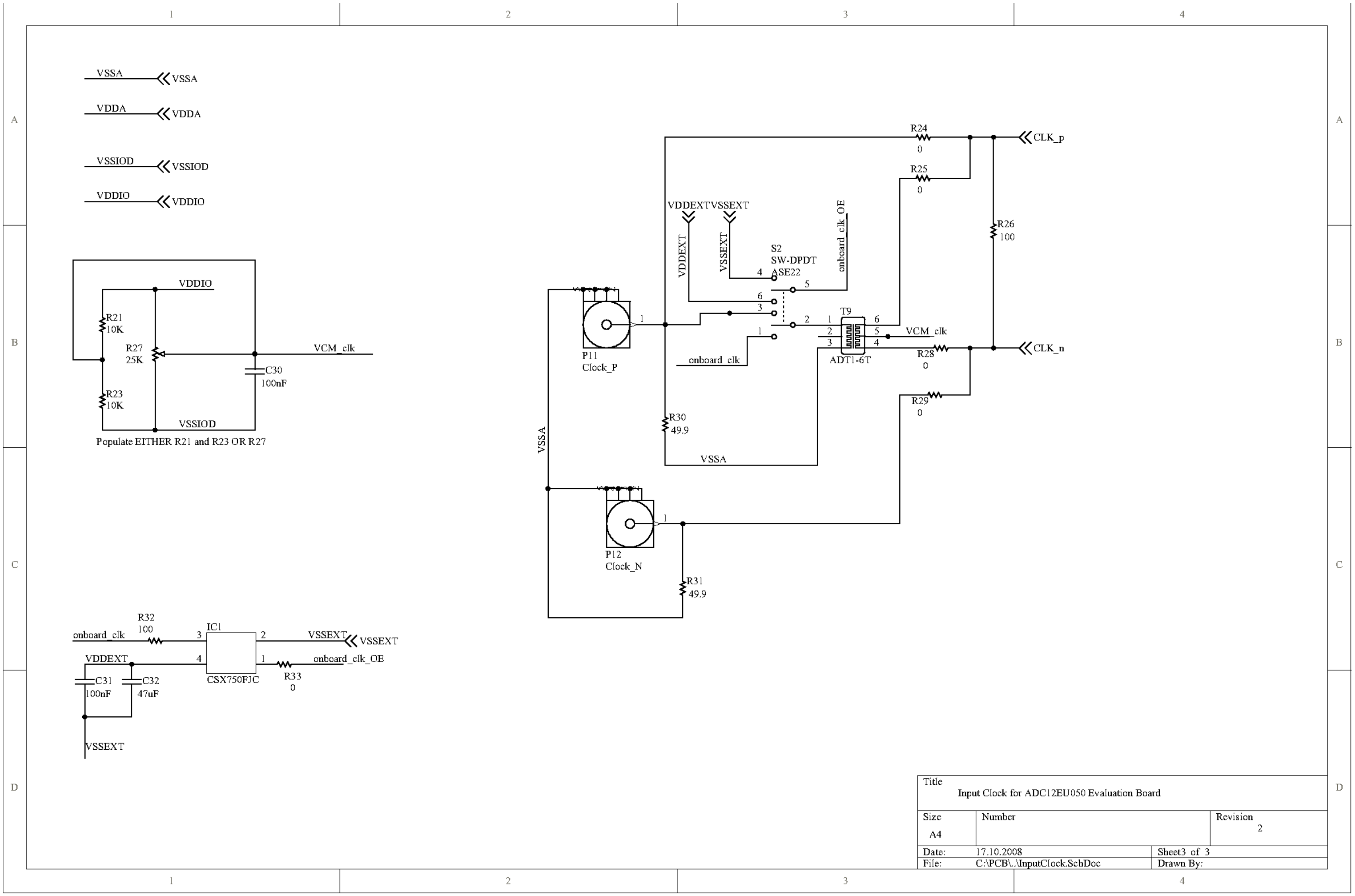

Figure 6. Schematic - 3 of 3

6 Evaluation Board Layout

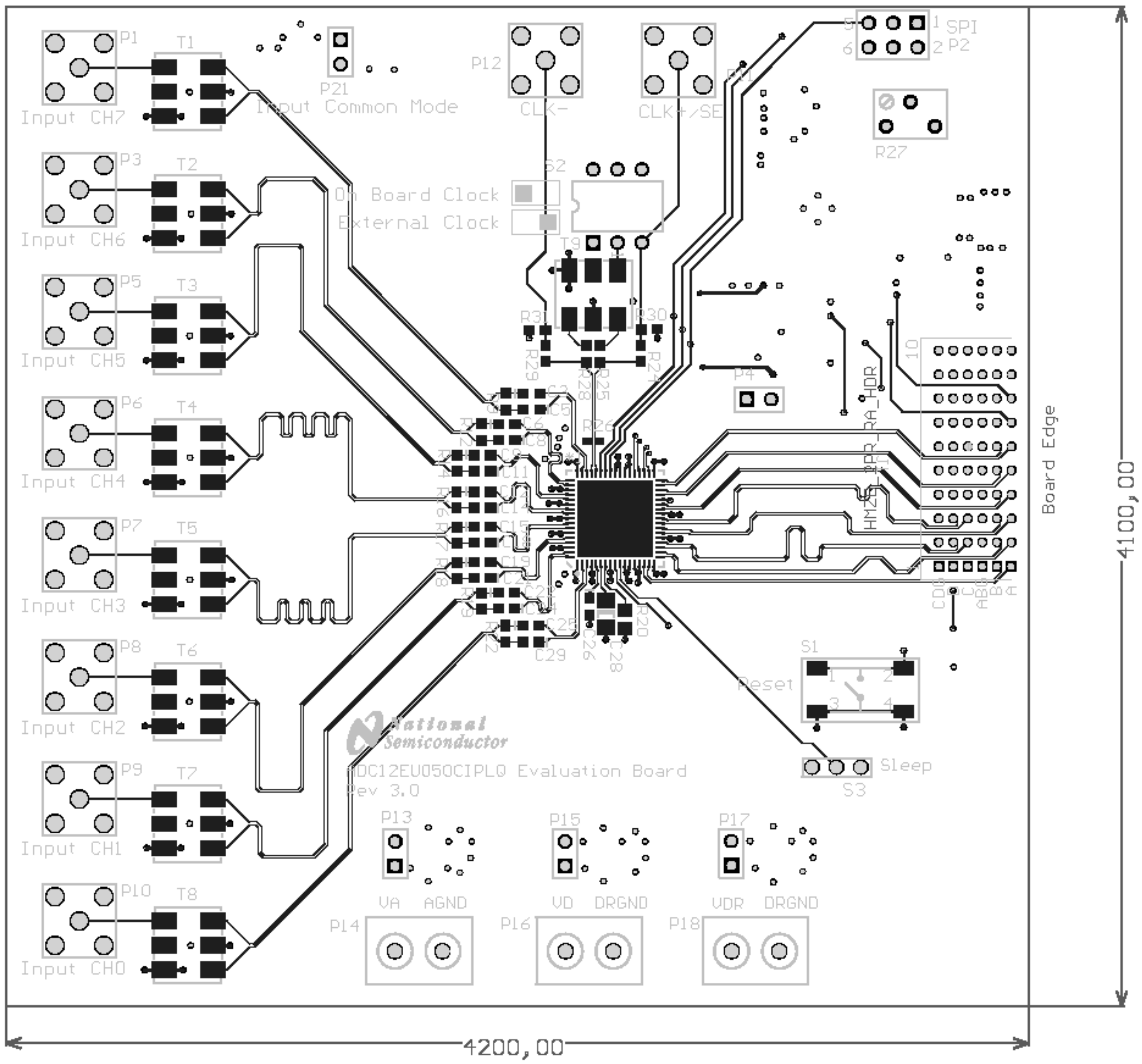

Figure 7. Layer 1: Top

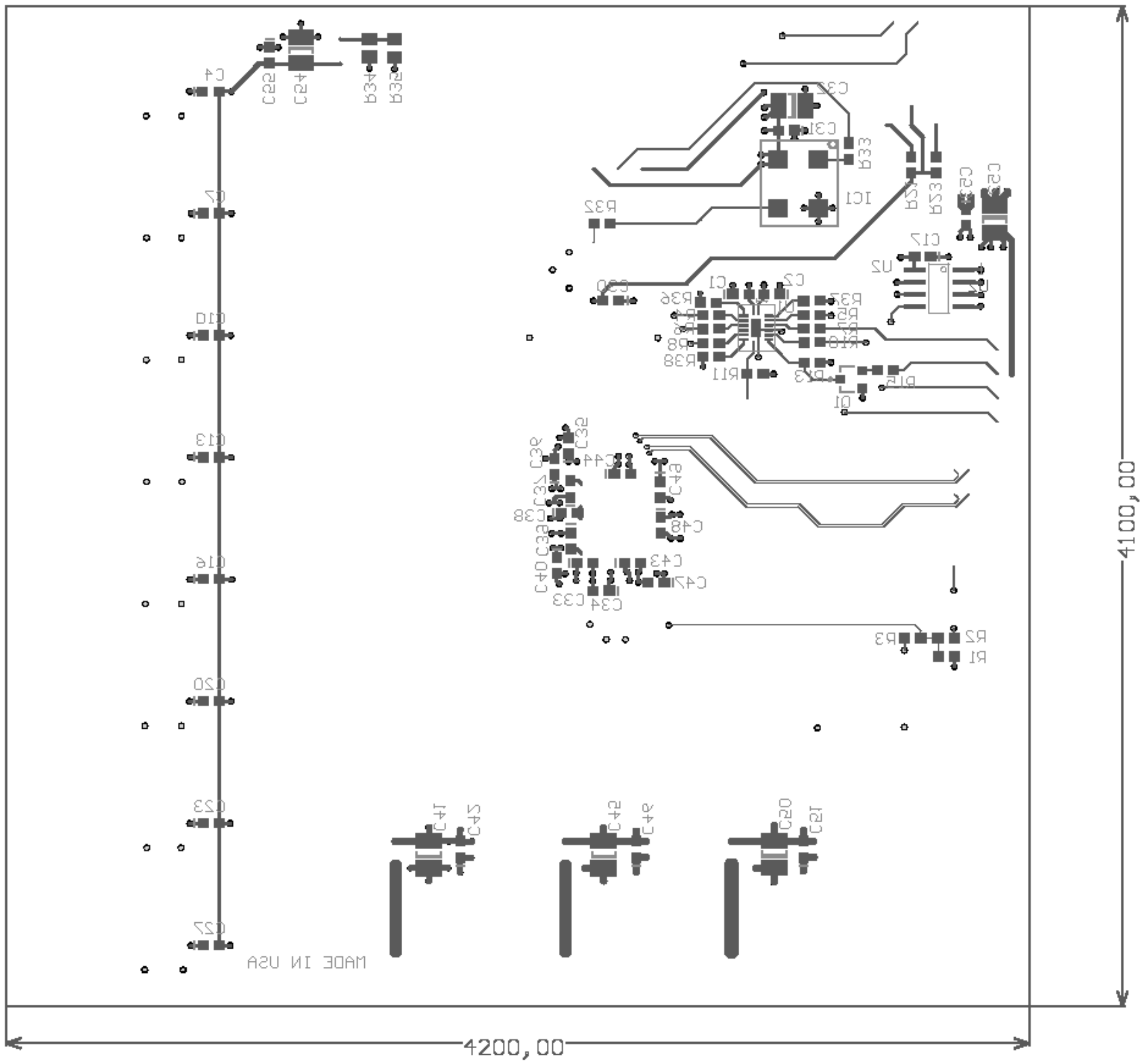

Figure 8. Layer 2 : Internal Ground Plane

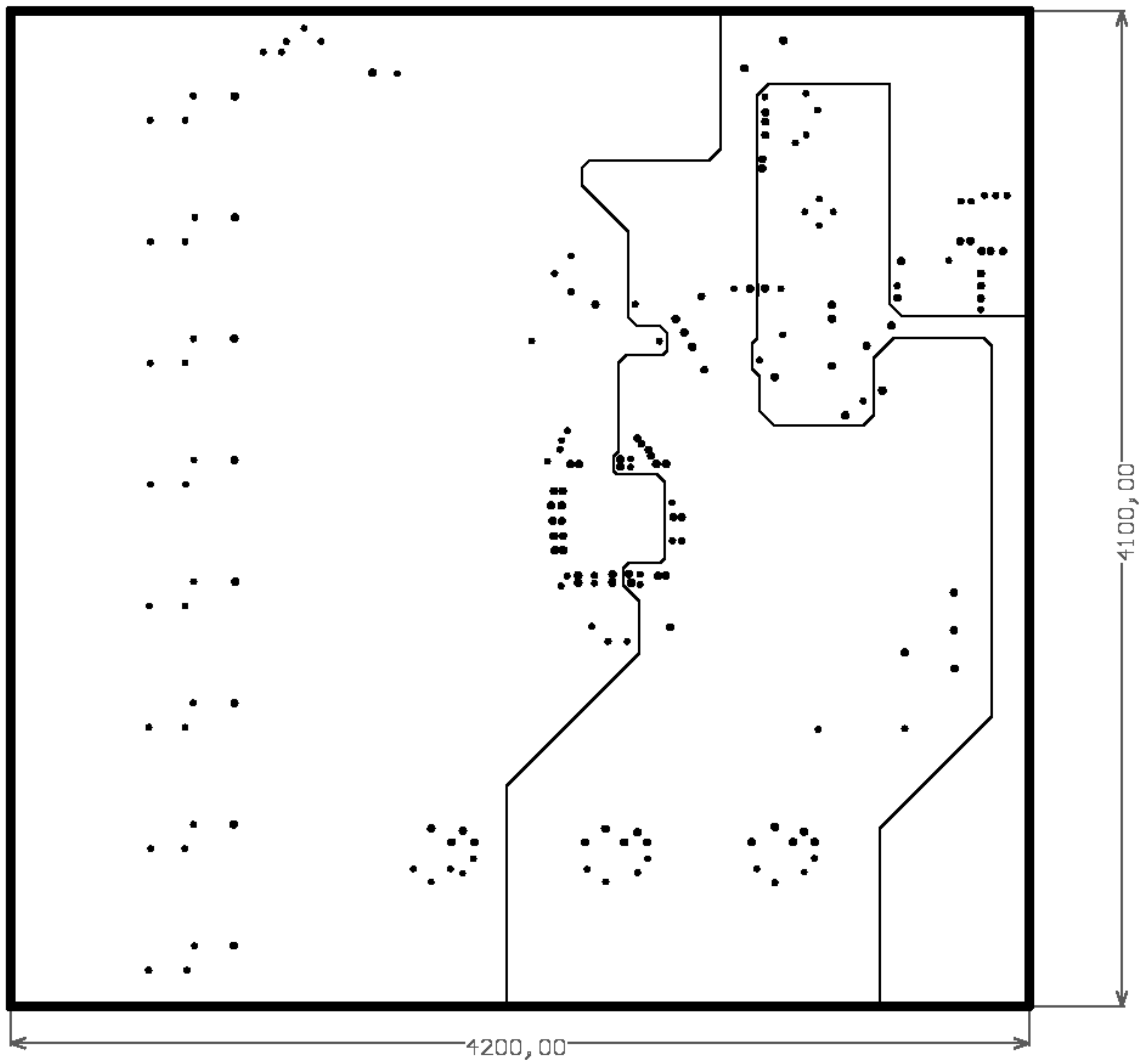

Figure 9. Layer 3 : Internal Power Plane

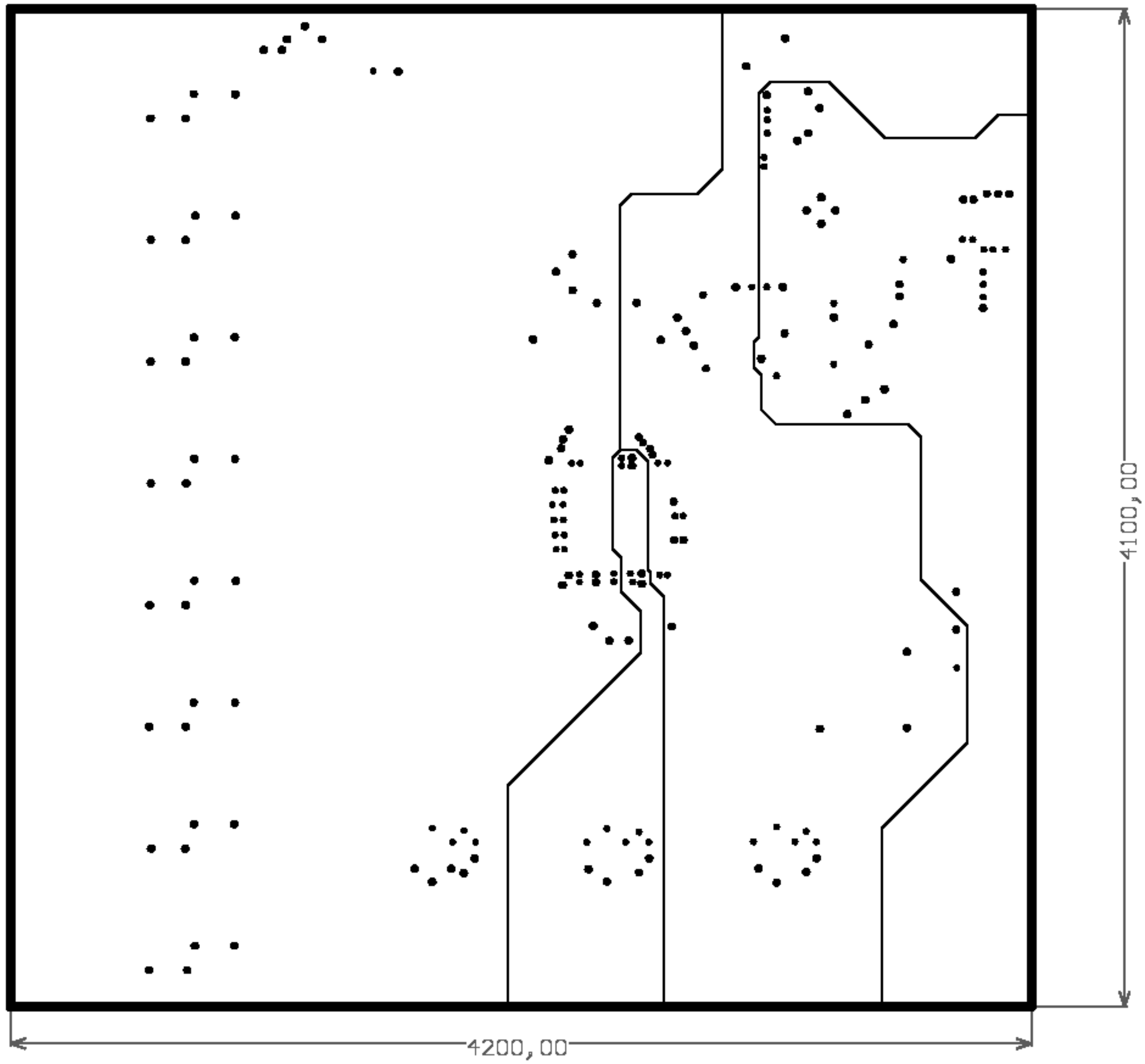

Figure 10. Layer 4: Bottom

7 Evaluation Board Bill of Materials

Table 2. Bill of Materials

QTY.	Designator	Footprint	Value	Description
1	*1	QFN10X10-68	ADC12EU050	ADC
48	C1–C31, C33–C40, C42–C44, C46–C49, C51, C53, C55	CC1608-0603	100nF	Capacitor (Semiconductor SIM Model)
1	C28	CC3216-1206	10uF	Capacitor (Semiconductor SIM Model)
6	C32, C41, C45, C50, C52, C54	CC3225-1210	47uF	Capacitor (Semiconductor SIM Model)
1	IC1	CSX750FJC	Citizen CSX750FJC50.000M-UT	Crystal Oscillator
1	J1	HMZD_2PR_RA_HDR	HMZd – Tyco Electronics part no 6469028-1	HMZd Connector 60 pin
10	P1, P3, P5–P12	SMA		RF Coaxial PCB Connector, MMCX; Thru-Hole, Vertical Mount Plug, 50 Ω Impedance
1	P2	HDR2X3	Header 2x3	Header, 3-Pin, Dual row
4	P14, P16, P18	LP2	Lumberg KRESS02 Terminal Block	Terminal Block
4	P4, P13, P15, P17, P21	HDR1X2	Header2x1	Jumper Wire
1	Q1	SOT23	BCW66H	NPN General Purpose Transistor
9	R33, R24, R25, R28, R29, R4, R8, R2, R3	CR1608-0603	0	Semiconductor Resistor
1	R15	CR1608-0603	2K	Semiconductor Resistor
1	R13	CR1608-0603	4.7K	Semiconductor Resistor
7	R11, R36, R37, R38, R1, R21, R23	CR1608-0603	10K	Semiconductor Resistor
1	R6	CR1608-0603	33	Semiconductor Resistor
10	R9, R12, R14, R16–R19, R22, R30, R31	CR1608-0603	49.9	Semiconductor Resistor
4	R32, R5, R7, R10	CR1608-0603	100	Semiconductor Resistor
3	R20, R34, R35	CR2012-0805	10K ± 1%	Semiconductor Resistor
1	R26	CR1005-0402	100	Semiconductor Resistor
1	R27	3296Y	25K	Potentiometer
1	S1	PushButton	OMRON B3S-1000	Push Button
1	S2	DIP-6	Tyco ASE22	Double-Pole, Double-Throw Switch
1	S3	SW-DIP1	EAO part no 09-03290-01	Single Switch
9	T1–T9	ADT1-6T	Mini Circuits ADT1-6T	Transformer
1	U1	DQFN_50M_16_2P5X3P5	FXL4TD245	4-bit level shifter
1	U2	SOIC8_05_WG244_L200	M24C02-WMN6P	EEPROM, STMicroelectronics, M24C02-WMN6P