

## Evaluating the AD9434 and AD9484 Analog-to-Digital Converters

### FEATURES

Full featured evaluation board for the [AD9434](#) and [AD9484](#)  
 SPI interface for setup and control  
 External, on-board oscillator or [AD9517](#) clocking options  
 Balun/transformer or amplifier input drive options  
 LDO regulator or switching power supply options  
 VisualAnalog and SPI controller software interfaces

### EQUIPMENT NEEDED

Analog signal source and antialiasing filter  
 Sample clock source (if not using the on-board oscillator)  
 2 switching power supplies (6.0 V, 2.5 A),  
 CUI EPS060250UH-PHP-SZ, provided  
 PC running Windows® 98 (2nd ed.), Windows 2000,  
 Windows ME, or Windows XP  
 USB 2.0 port, recommended (USB 1.1 compatible)  
[AD9434/AD9484](#) board  
[HSC-ADC-EVALCZ](#) FPGA-based data capture kit

### DOCUMENTS NEEDED

[AD9434](#) or [AD9484](#) data sheet  
[HSC-ADC-EVALCZ](#) data sheet

[AN-905](#) Application Note, *VisualAnalog Converter Evaluation Tool Version 1.0 User Manual*

[AN-878](#) Application Note, *High Speed ADC SPI Control Software*

[AN-877](#) Application Note, *Interfacing to High Speed ADCs via SPI*

[AN-835](#) Application, *Understanding High Speed ADC Testing and Evaluation*

### SOFTWARE NEEDED

VisualAnalog

SPI controller

### GENERAL DESCRIPTION

This document describes the [AD9434](#) and [AD9484](#) evaluation board, which provides all of the support circuitry required to operate the [AD9434](#) and [AD9484](#) in their various modes and configurations. The application software used to interface with the devices is also described.

The [AD9434](#) and [AD9484](#) data sheets provide additional information and should be consulted when using the evaluation board. All documents and software tools are available at [www.analog.com/fifo](http://www.analog.com/fifo). For additional information or questions, send an email to [highspeed.converters@analog.com](mailto:highspeed.converters@analog.com).

### TYPICAL MEASUREMENT SETUP

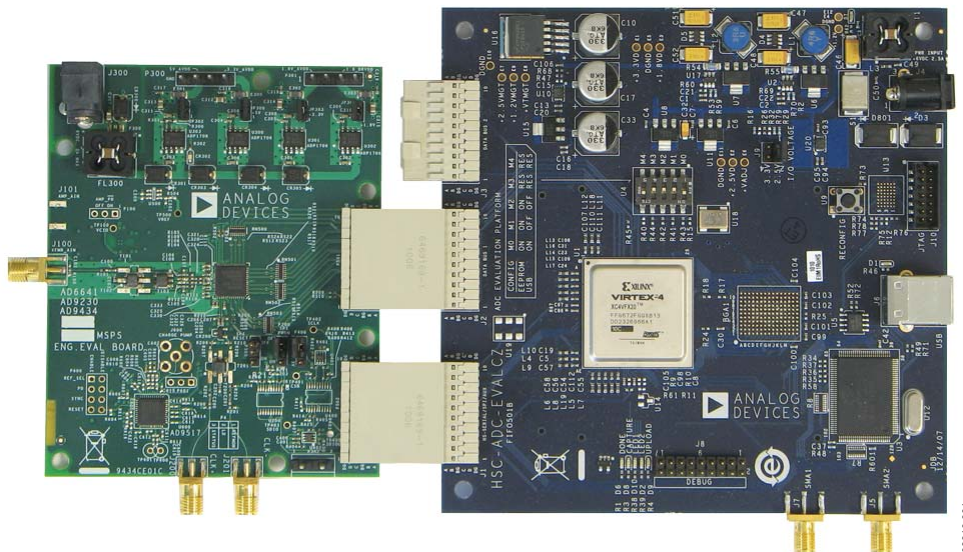


Figure 1. [AD9434](#) and [AD9484](#) Family Evaluation Board and [HSC-ADC-EVALCZ](#) Data Capture Board

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**REVISION HISTORY**

7/11—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

The evaluation board provides all of the support circuitry required to operate the [AD9434](#) and [AD9484](#) in their various modes and configurations. Figure 2 shows the typical bench characterization setup used to evaluate the ac performance. It is critical that the signal sources used for the analog input and clock have very low phase noise ( $<1$  ps rms jitter) to realize the optimum performance of the signal chain. Proper filtering of the analog input signal to remove harmonics and lower the integrated or broadband noise at the input is necessary to achieve the specified noise performance.

The evaluation board covers both the [AD9484](#) and [AD9484](#) ADCs. See the Evaluation Board Software Quick Start Procedures section to get started, and see Figure 15 to Figure 28 for the complete schematics and layout diagrams. These diagrams illustrate the routing and grounding techniques that should be applied at the system level when designing application boards using these converters.

### POWER SUPPLIES

This evaluation board comes with a wall-mountable switching power supply that provides a 6 V, 2 A maximum output. Connect the supply to the rated 100 V to 240 V ac wall outlet at 47 Hz to 63 Hz. The output from the supply is provided through a 2.1 mm inner diameter jack that connects to the printed circuit board (PCB) at J300. The 6 V supply is fused and conditioned on the PCB before connecting to the low dropout linear regulators (default configuration) that supply the proper bias to each of the various sections on the board.

The evaluation board can be powered in a nondefault condition using external bench power supplies. To do this, JP301 through JP303 can be removed to disconnect the outputs from the on-board LDOs. This enables the user to bias each section of the board individually. Use P300 and P301 to connect a different supply for each section. A 1.8 V supply is needed with a 1 A

current capability for DUT\_AVDD and DRVDD; however, it is recommended that separate supplies be used for both analog and digital domains. To operate the evaluation board using the SPI and alternate clock options, a separate 3.3 V analog supply is needed in addition to the other supplies. This 3.3 V supply should have a 1 A current capability.

An additional 5V\_AVDD supply is used to bias the optional input path amplifier. If used, this supply should have a 1 A current capability.

### INPUT SIGNALS

When connecting the clock and analog source, use clean signal generators with low phase noise, such as the Rohde & Schwarz SMA or HP 8644B signal generators or an equivalent. Use a 1 meter, shielded, RG-58, 50  $\Omega$  coaxial cable for connecting to the evaluation board. Enter the desired frequency and amplitude in the signal generators (see the Specifications section in the data sheet of the respective part). When connecting the analog input source, use of a multipole, narrow-band band-pass filter with 50  $\Omega$  terminations is recommended. Analog Devices, Inc., uses TTE, Allen Avionics, and K&L band-pass filters. The filters should be connected directly to the evaluation board.

If an external clock source is used, it should also be supplied with a clean signal generator as previously specified. Typically, most Analog Devices evaluation boards can accept  $\sim 2.8$  V p-p or 13 dBm sine wave input for the clock.

### OUTPUT SIGNALS

The default setup uses the Analog Devices high speed converter evaluation platform ([HSC-ADC-EVALCZ](#)) for data capture. The LVDS output signals are routed to the FPGA on the data capture board.

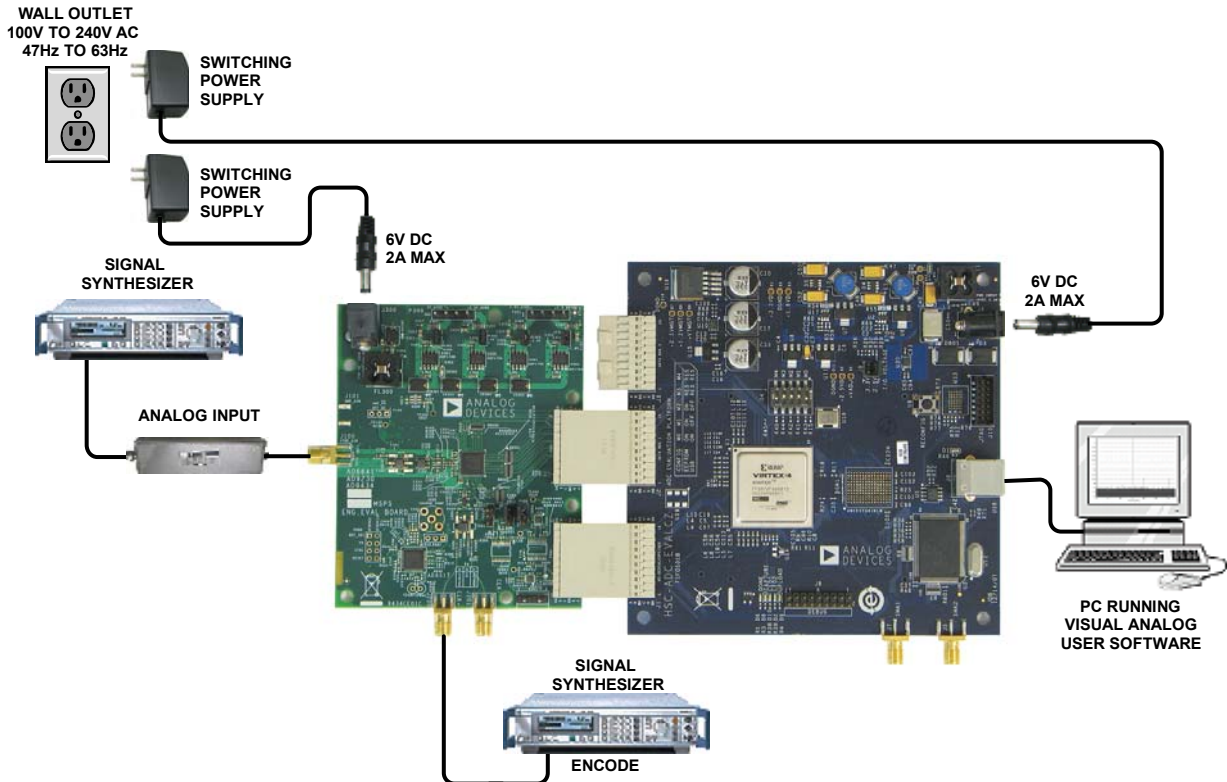


Figure 2. Evaluation Board Connection

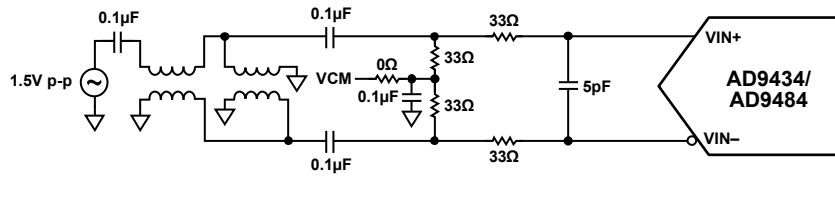


Figure 3. Default Analog Input Configuration of the [AD9434](#) and [AD9484](#)

**DEFAULT OPERATION AND JUMPER SELECTION SETTINGS**

This section explains the default and optional settings or modes allowed on the [AD9434](#) and [AD9484](#) evaluation board.

**Power Circuitry**

Connect the switching power supply that is supplied in the evaluation kit between a rated 100 V to 240 V ac wall outlet (at 47 Hz to 63 Hz) and J300.

**Analog Input**

The input on the evaluation board is set up for a double balun-coupled analog input with a 50 Ω impedance (see Figure 3). The analog input to the [AD9434](#) and [AD9484](#) is a differential buffer. For best dynamic performance, source impedances driving VIN+ and VIN- are matched such that common-mode settling errors are symmetrical. The analog input is optimized to provide superior wideband performance and requires that the analog inputs be driven differentially. SNR and SINAD performance

degrades significantly if the analog input is driven with a single-ended signal.

The analog inputs are self-biased by an on-chip reference to provide a common-mode voltage level of nominally 1.7 V.

An internal differential voltage reference creates positive and negative reference voltages that define the 1.5 V p-p fixed span of the ADC core. This internal voltage reference can be adjusted by means of an SPI control.

**VREF**

The [AD9434](#) VREF pin (Pin 31) allows the user to monitor the on-board voltage reference or provide an external reference (requires configuration through the SPI). The three optional settings are internal VREF (the pin is connected to 20 kΩ to ground), export VREF, and import VREF. See the settings for Register 0x18 in Table 1.

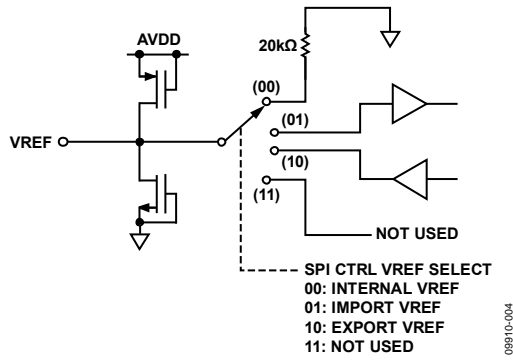


Figure 4. Equivalent VREF Input/Output Circuit

**Clock Circuitry for the AD9434/AD9484**

The default clock input circuit on the evaluation board uses a simple transformer-coupled circuit using a high bandwidth

1:1 impedance ratio transformer (T201) that adds a low amount of jitter to the clock path. The clock input is 50 Ω terminated and ac-coupled to handle single-ended sine wave types of inputs. The transformer converts the single-ended input to a differential signal that is clipped by CR200 before entering the ADC clock inputs.

The evaluation board is by default set up to be clocked with the transformer-coupled input network connected to the external clock source through the SMA connector, J200 (labeled CLK+).

**PDWN**

To enable the power-down feature, add a shorting jumper across P200 at Pin 1 and Pin 2 to connect the PDWN pin to AVDD.

**Table 1. Register 0x18 Settings**

Address (Hexadecimal)	Parameter Name	Bits[7:6]	Bit 5	Bits[4:0]
0x18	Input range	VREF select <sup>1</sup> 00 = internal V <sub>REF</sub> (20 kΩ pull-down internally)  01 = import V <sub>REF</sub> (apply 0.59 V to 0.8 V to Pin 31)  10 = export V <sub>REF</sub> (monitor)  11 = not used	0	Input voltage range setting (V) 11100 = 1.60 11101 = 1.58 11110 = 1.55 11111 = 1.52 00000 = 1.50 00001 = 1.47 00010 = 1.44 00011 = 1.42 00100 = 1.39 00101 = 1.36 00110 = 1.34 00111 = 1.31 01000 = 1.28 01001 = 1.26 01010 = 1.23 01011 = 1.20 01100 = 1.18

<sup>1</sup> VREF x 2 = input range.

## EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

This section provides quick start procedures for using the [AD9434](#) and [AD9484](#) evaluation board. Both the default and optional settings are described.

### CONFIGURING THE BOARD

Before using the software for testing, configure the evaluation board as follows:

1. Connect the [AD9434](#) evaluation board to the [HSC-ADC-EVALCZ](#) boards as shown in Figure 1.
2. Connect one 6 V, 2 A switching power supply (such as the CUI EPS060250UH-PHP-SZ supplied) to the [AD9434](#) board.
3. Connect one 5 V, 3 A (6 V, 2 A can optionally be used) switching power supply (such as the CUI KSAFD0500300W1US supplied) to the [HSC-ADC-EVALCZ](#) board.
4. Connect the [HSC-ADC-EVALCZ](#) board to the PC with a USB cable. (Connect to J6.)
5. On the ADC evaluation board, make sure that jumpers are on the J300 to J303 headers to connect the power supplies. Connect Pin 1 to Pin 2 of P200 and Pin 2 to Pin 3 of P400 to connect the SPI bus to the ADC.
6. On the ADC evaluation board, provide a clean, low jitter clock source to connector J200 at the desired ADC conversion rate.
7. On the ADC evaluation board, use a clean signal generator with low phase noise to provide an input signal at the J100 connector. Use a 1 meter, shielded, RG-58, 50  $\Omega$  coaxial cable to connect the signal generator. For best results, use a narrow-band, band-pass filter with 50  $\Omega$  terminations and an appropriate center frequency. (Analog Devices uses TTE, Allen Avionics, and K&L band-pass filters.)

### USING THE SOFTWARE FOR TESTING

#### Setting Up the ADC Data Capture

After configuring the board, set up the ADC data capture using the following steps:

1. Open VisualAnalog® on the connected PC. The appropriate part type should be listed in the status bar of the **VisualAnalog – New Canvas** window. Select the template that corresponds to the type of testing to be performed (see Figure 5 where the [AD9434](#) is shown as an example).

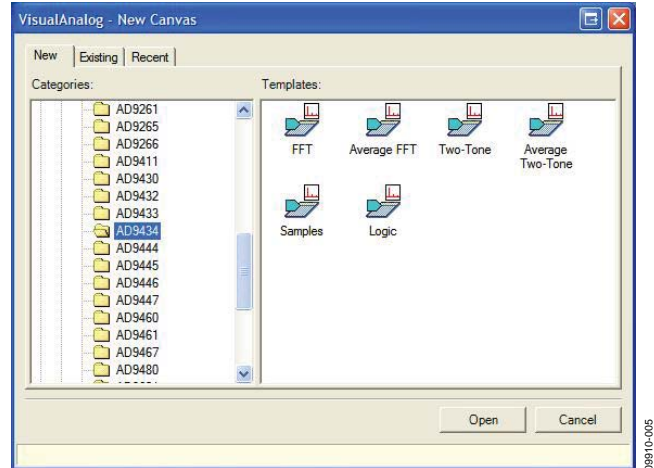


Figure 5. VisualAnalog, New Canvas Window

2. After the template is selected, a message appears asking if the default configuration can be used to program the FPGA (see Figure 6). Click **Yes**, and the window closes.

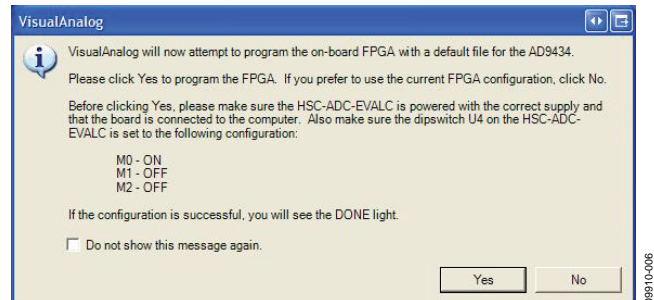


Figure 6. VisualAnalog Default Configuration Message

3. To change features to settings other than the default settings, click the **Expand Display** button, located on the bottom right corner of the VisualAnalog window, to see what is shown in Figure 8.
4. Detailed instructions for changing the features and capture settings can be found in the [AN-905](#) Application Note, *VisualAnalog Converter Evaluation Tool Version 1.0 User Manual*. After the changes are made to the capture settings, click **Collapse Display** (see Figure 7).

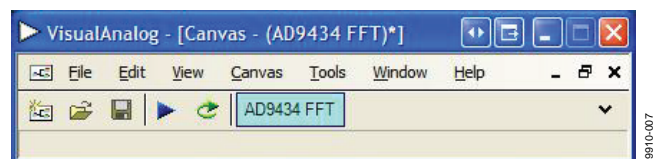


Figure 7. VisualAnalog Window Toolbar, Collapsed Display

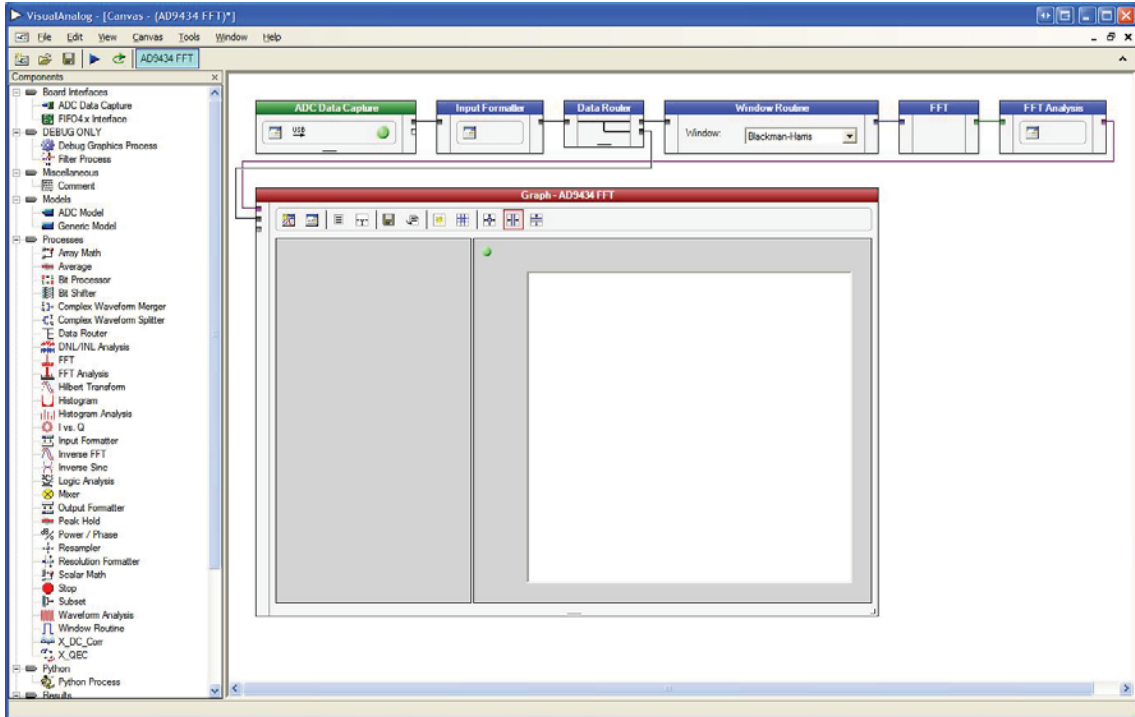


Figure 8. VisualAnalog, Main Window

**Setting Up the SPI Controller Software**

After the ADC data capture board setup is complete, set up the SPI controller software using the following procedure:

1. Open the SPI controller software by going to the **Start** menu or by double-clicking the **SPIController** software desktop icon. If prompted for a configuration file, select the appropriate one. If not, check the title bar of the window to determine which configuration is loaded. If necessary, choose **Cfg Open** from the **File** menu and select the appropriate file based on your part type. Note that the **CHIP ID(1)** field should be filled to indicate whether the correct SPI controller configuration file is loaded (see Figure 9).

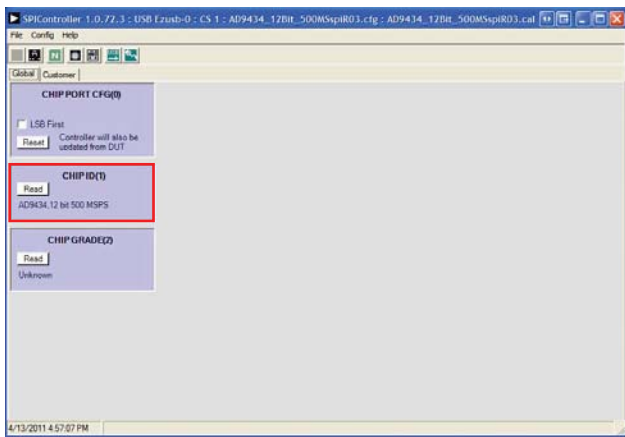


Figure 9. SPI Controller, CHIP ID(1) Box

2. Click the **New DUT** button in the **SPIController** window (see Figure 10).

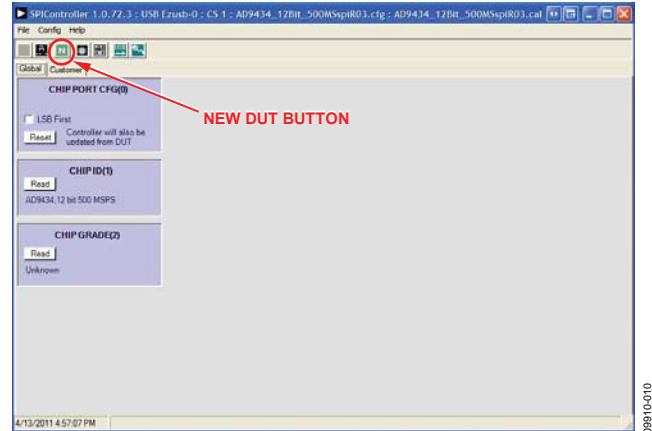


Figure 10. SPI Controller, New DUT Button

3. Note that other settings can be changed in the **Customer** tab of the **SPIController** window. See the appropriate part data sheet; the [AN-878](#) Application Note, *High Speed ADC SPI Control Software*; and the [AN-877](#) Application Note, *Interfacing to High Speed ADCs via SPI*, for additional information.

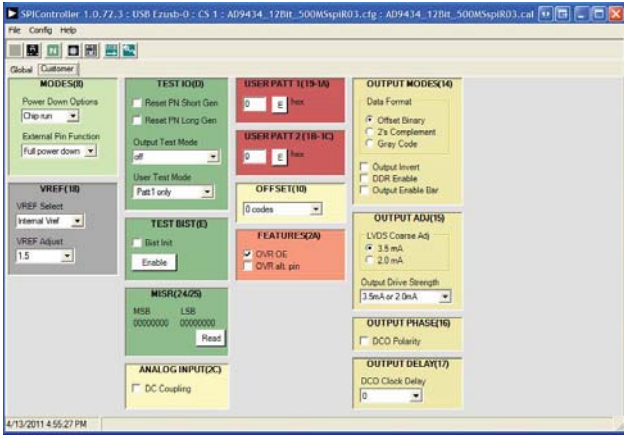


Figure 11. SPI Controller, Customer Tab

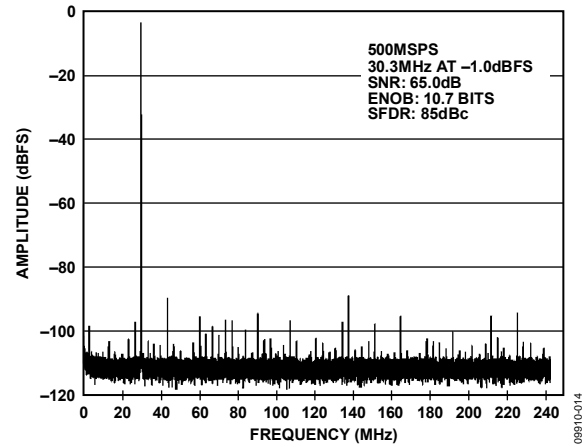


Figure 14. Typical FFT, AD9434

- Click the **Run** button in the **VisualAnalog** toolbar (see Figure 12).

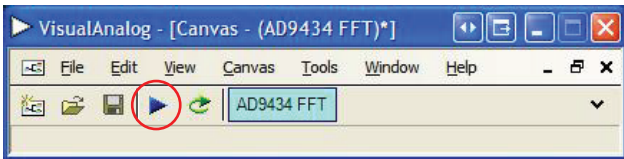


Figure 12. Run Button (Encircled in Red) in the VisualAnalog Toolbar, Collapsed Display

### Adjusting the Amplitude of the Input Signal

The next step is to adjust the amplitude of the input signal as follows:

- Adjust the amplitude of the input signal so that the fundamental is at the desired level. Examine the **Fund Power** reading in the left panel of the **VisualAnalog Graph - AD9434 Average FFT** window (see Figure 13).

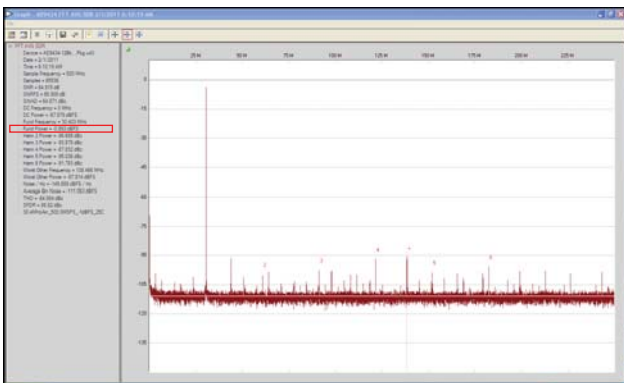


Figure 13. Graph Window of VisualAnalog

- Click the disk icon within the **Graph** window to save the performance plot data as a .csv formatted file. See Figure 14 for an example.

### Troubleshooting Tips

If the FFT plot appears abnormal, do the following:

- If you see a normal noise floor when you disconnect the signal generator from the analog input, be sure you are not overdriving the ADC. Reduce the input level, if necessary.
- In **VisualAnalog**, click the **Settings** button in the **Input Formatter** block. Check that **Number Format** is set to the correct encoding (offset binary by default). Repeat for the other channel.

If the FFT appears normal but the performance is poor, do the following:

- Make sure an appropriate filter is used on the analog input.
- Make sure the signal generators for the clock and the analog input are clean (low phase noise).
- Change the analog input frequency slightly if noncoherent sampling is being used.
- Make sure the SPI configuration file matches the product being evaluated.

If the FFT window remains blank after **Run** is clicked, do the following:

- Make sure the evaluation board is securely connected to the **HSC-ADC-EVALCZ** board.
- Make sure the FPGA has been programmed by verifying that DONE LED is illuminated on the **HSC-ADC-EVALCZ** board. If this LED is not illuminated, make sure the U4 switch on the board is in the correct position for USB CONFIG.
- Make sure the correct FPGA program was installed by selecting the **Settings** button in the **ADC Data Capture** block in **VisualAnalog**. Then select the **FPGA** tab and verify that the proper FPGA bin file is selected for the part.

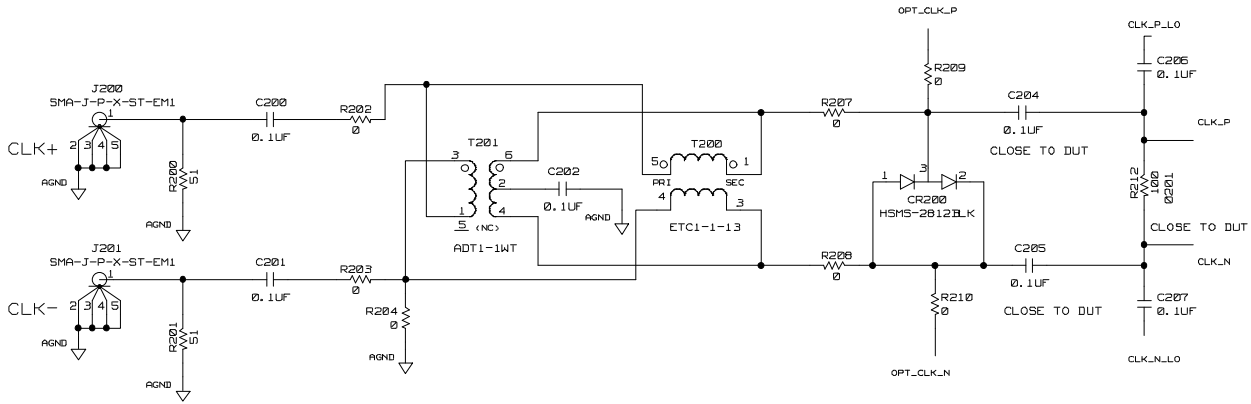
If **VisualAnalog** indicates that the FIFO capture timed out,

- Make sure all power and USB connections are secure.
- Confirm that a clock signal is present at the ADC sampling rate.

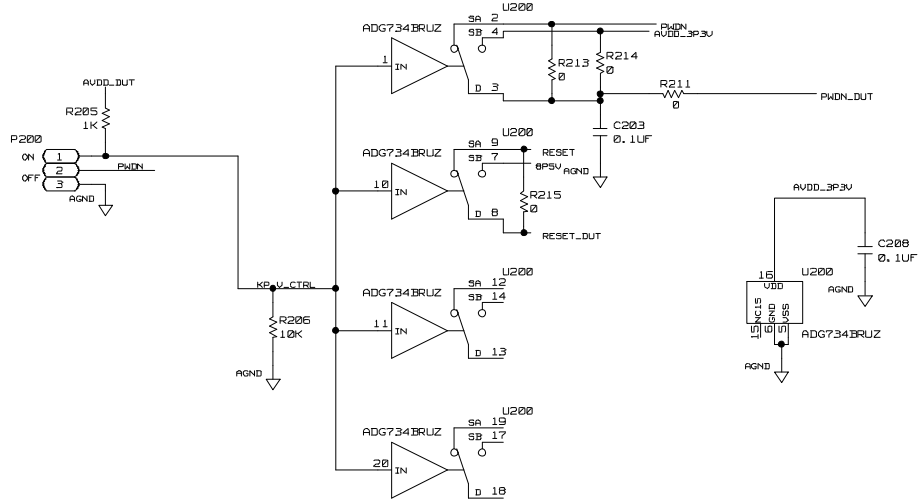




DEFAULT CLOCK PATH



KILOPASS VOLTAGE



NOTE: ADG734 SYMBOL IS SHOWN WITH INPUT = LOGIC 1  
 Figure 16. Clock Input Circuits

09810-016

## WALWART POWER SUPPLY INPUT 5VDC, 2A MAX

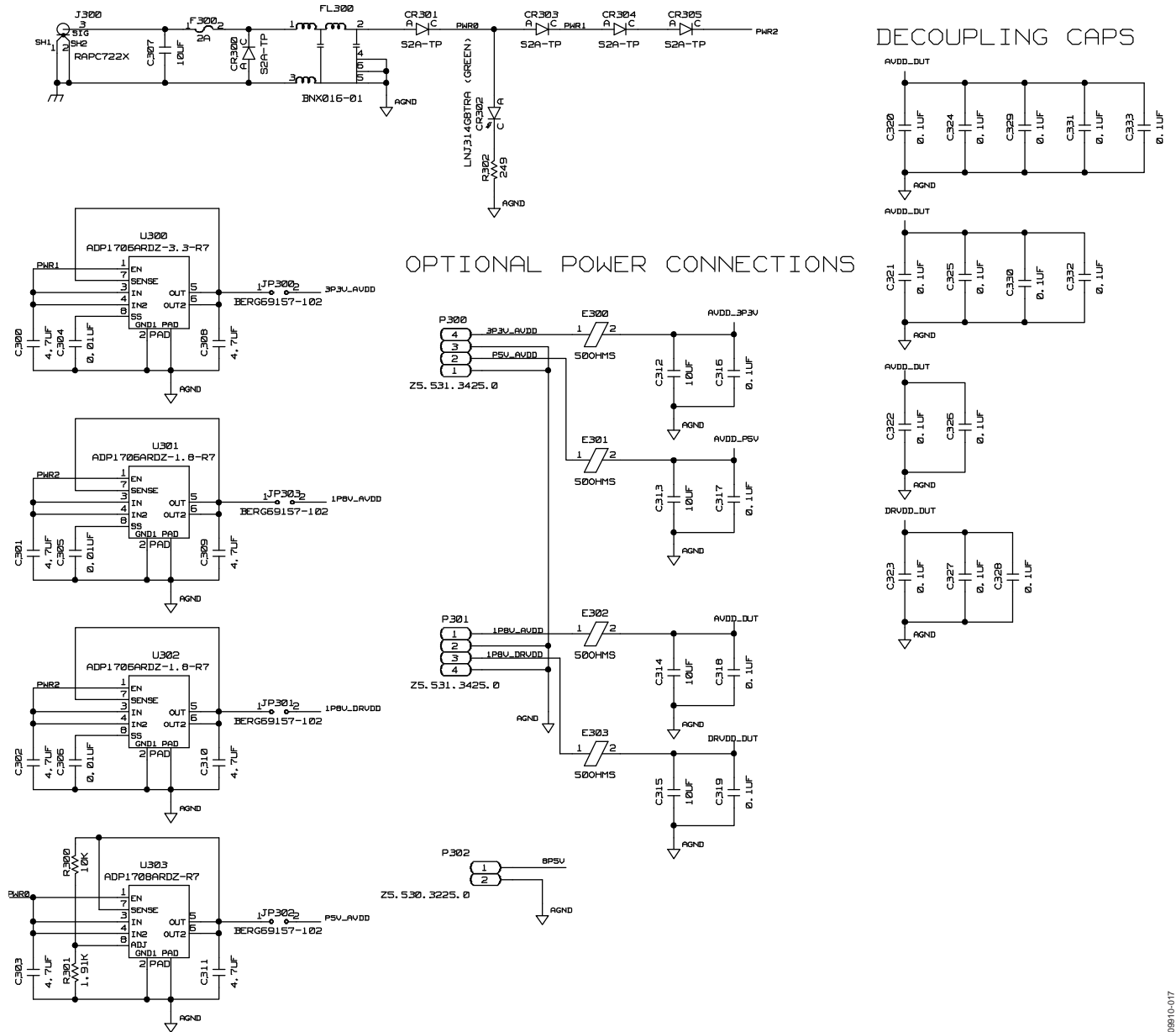


Figure 17. Board Power Supply Circuits

09810-017

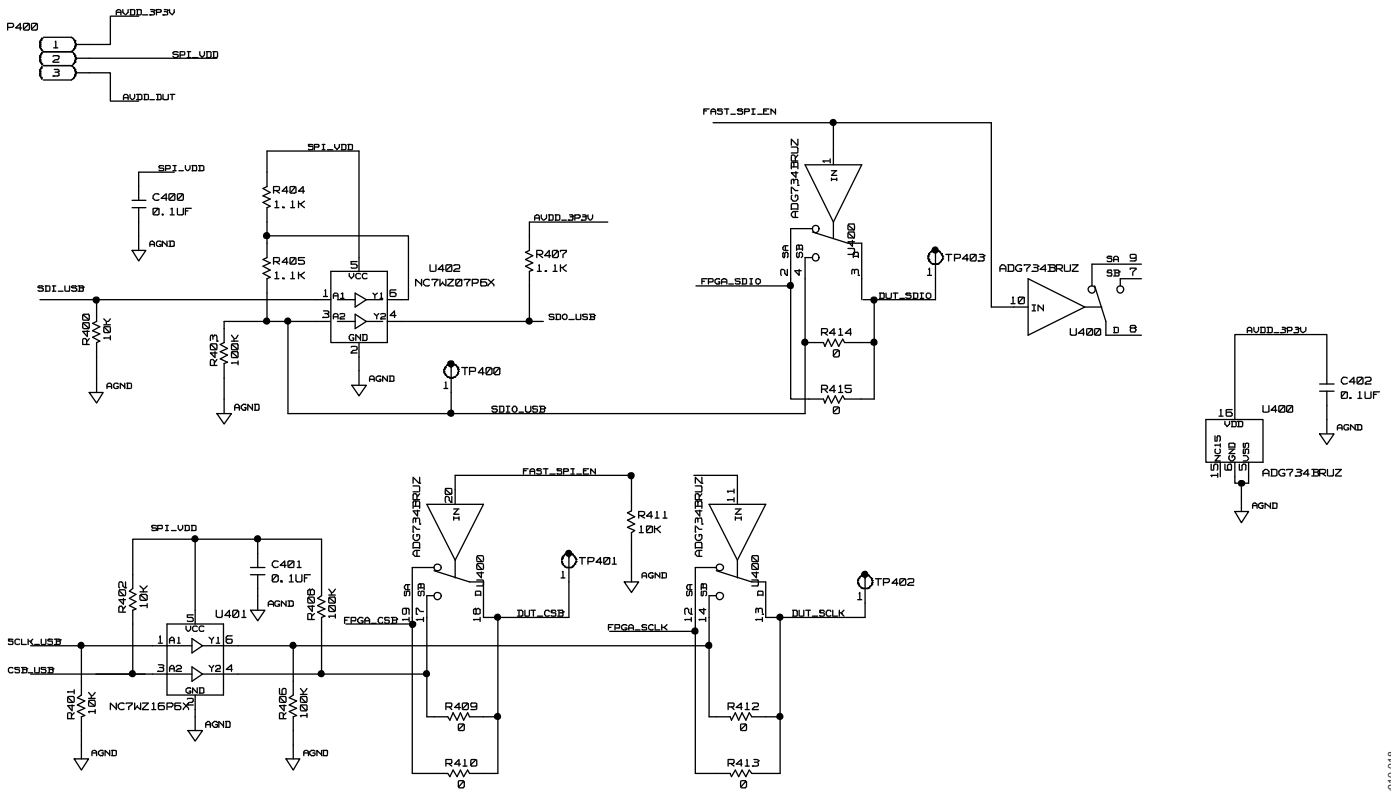


Figure 18. SPI Interface Circuits

09910-018



OPTIONAL CLOCK PATH CIRCUIT

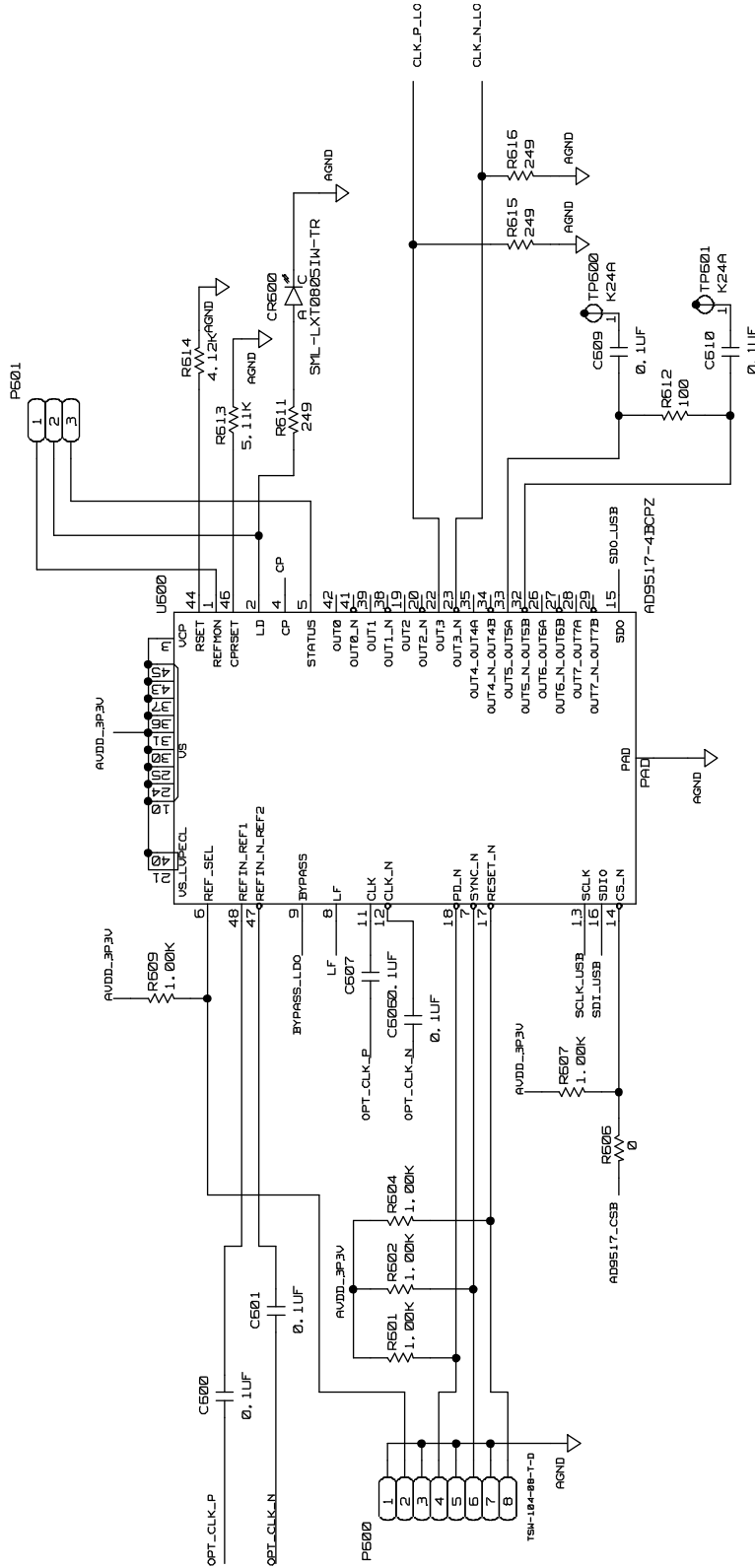
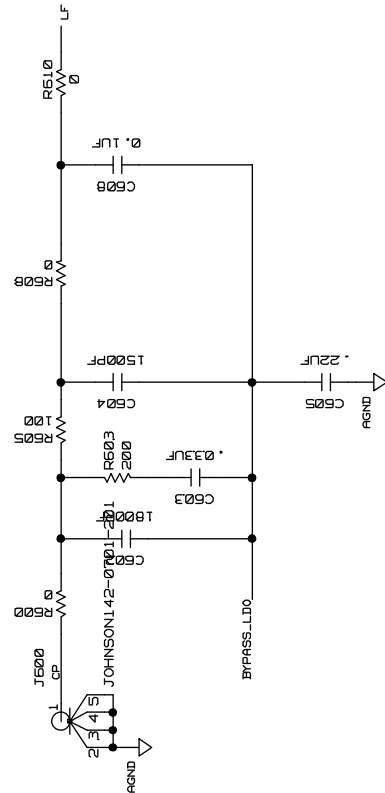
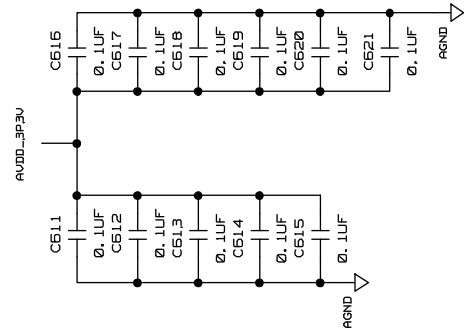


Figure 20. Optional AD9517 Clock Input Circuit

CHARGE PUMP FILTER



DECOUPLING



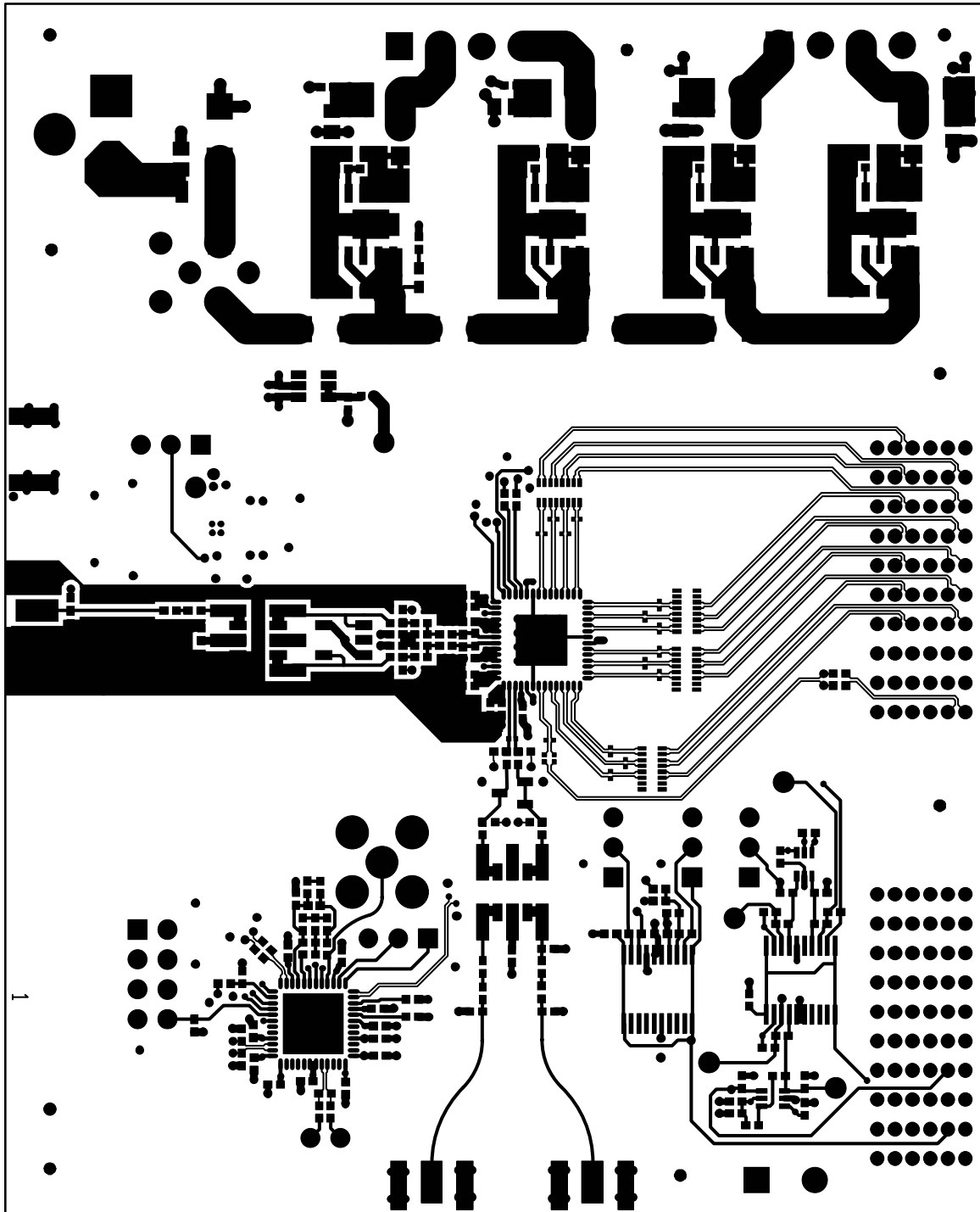


Figure 21. Top Side

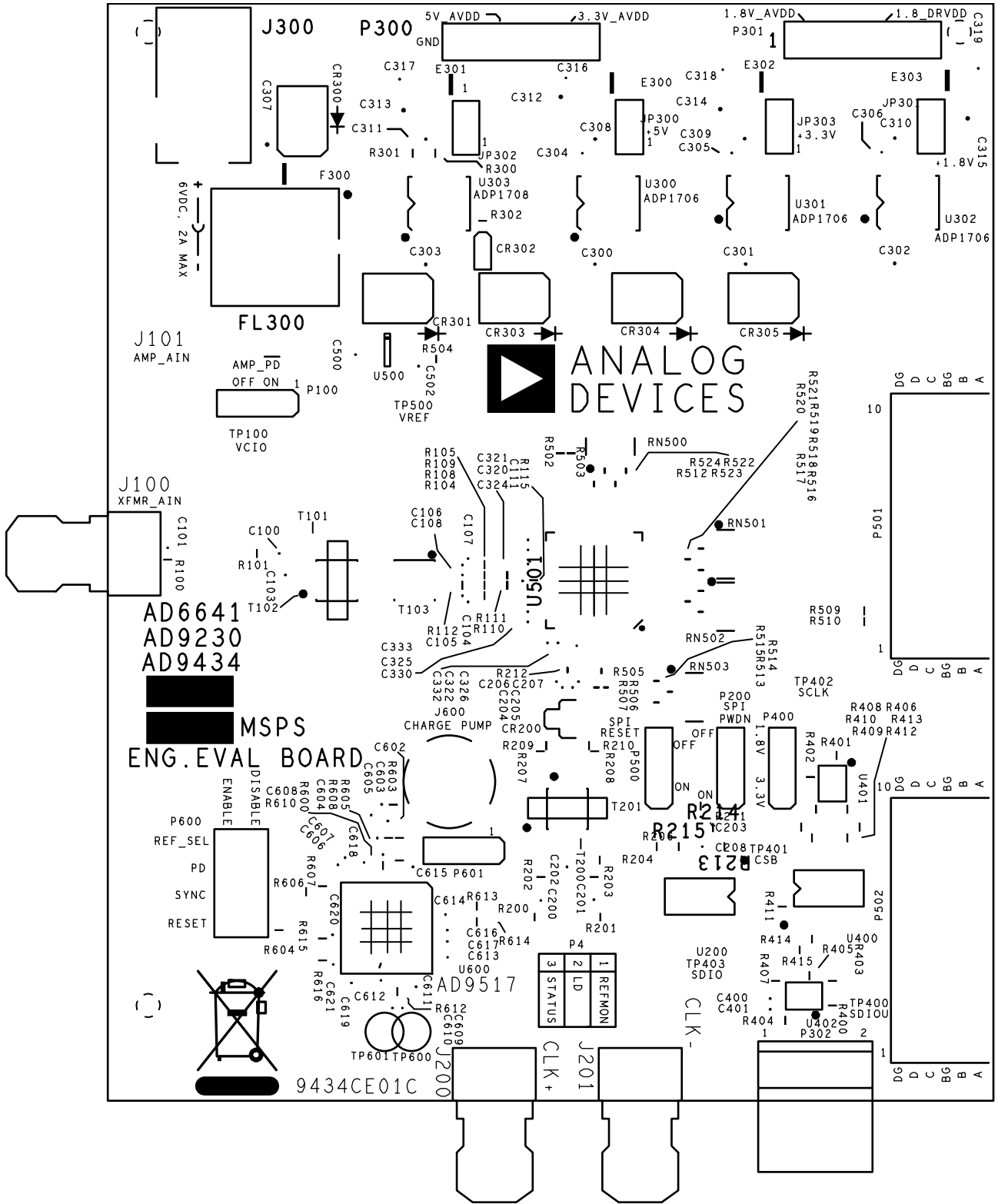


Figure 22. Top Silkscreen



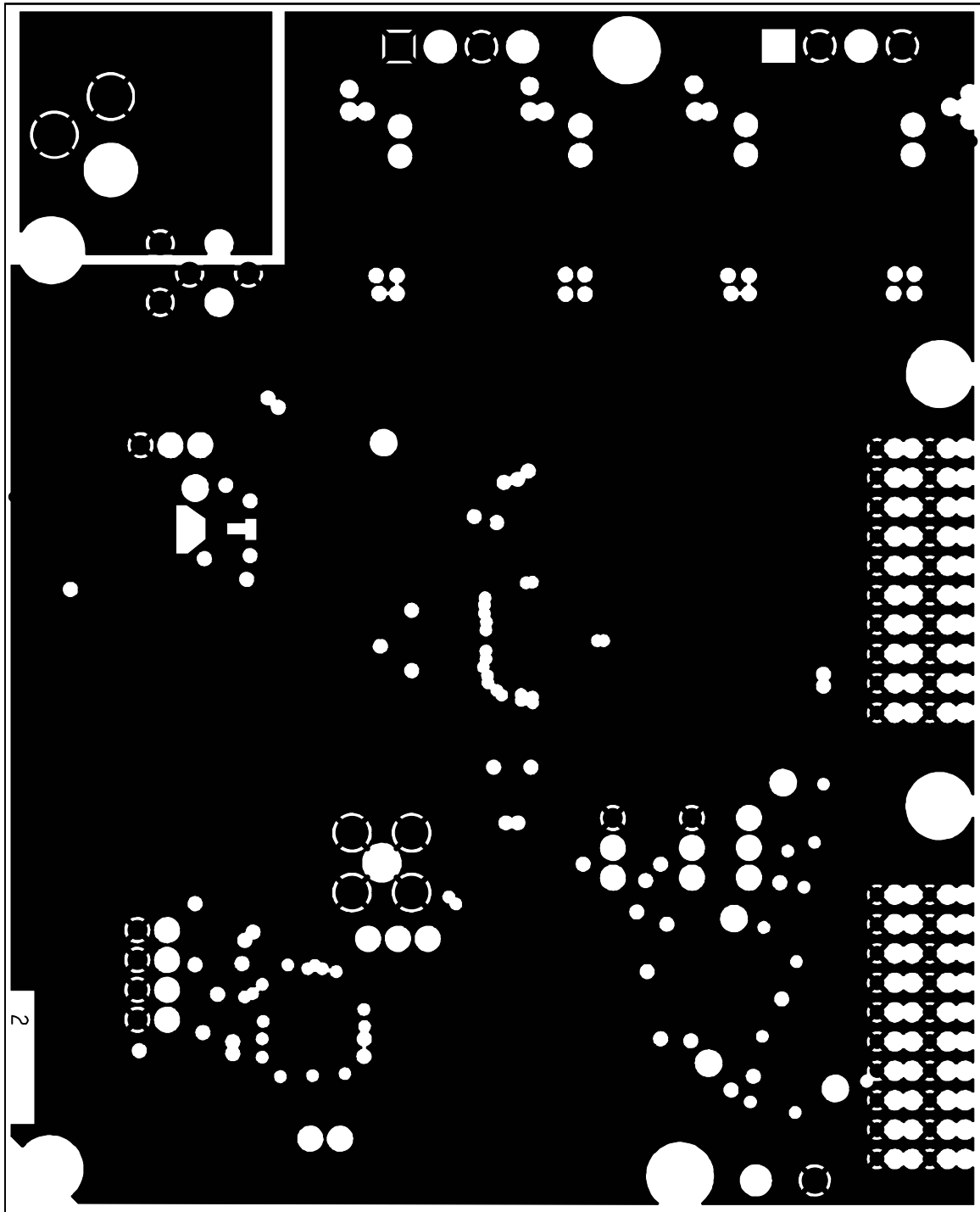


Figure 23. Ground Plane (Layer 2)

08910-023

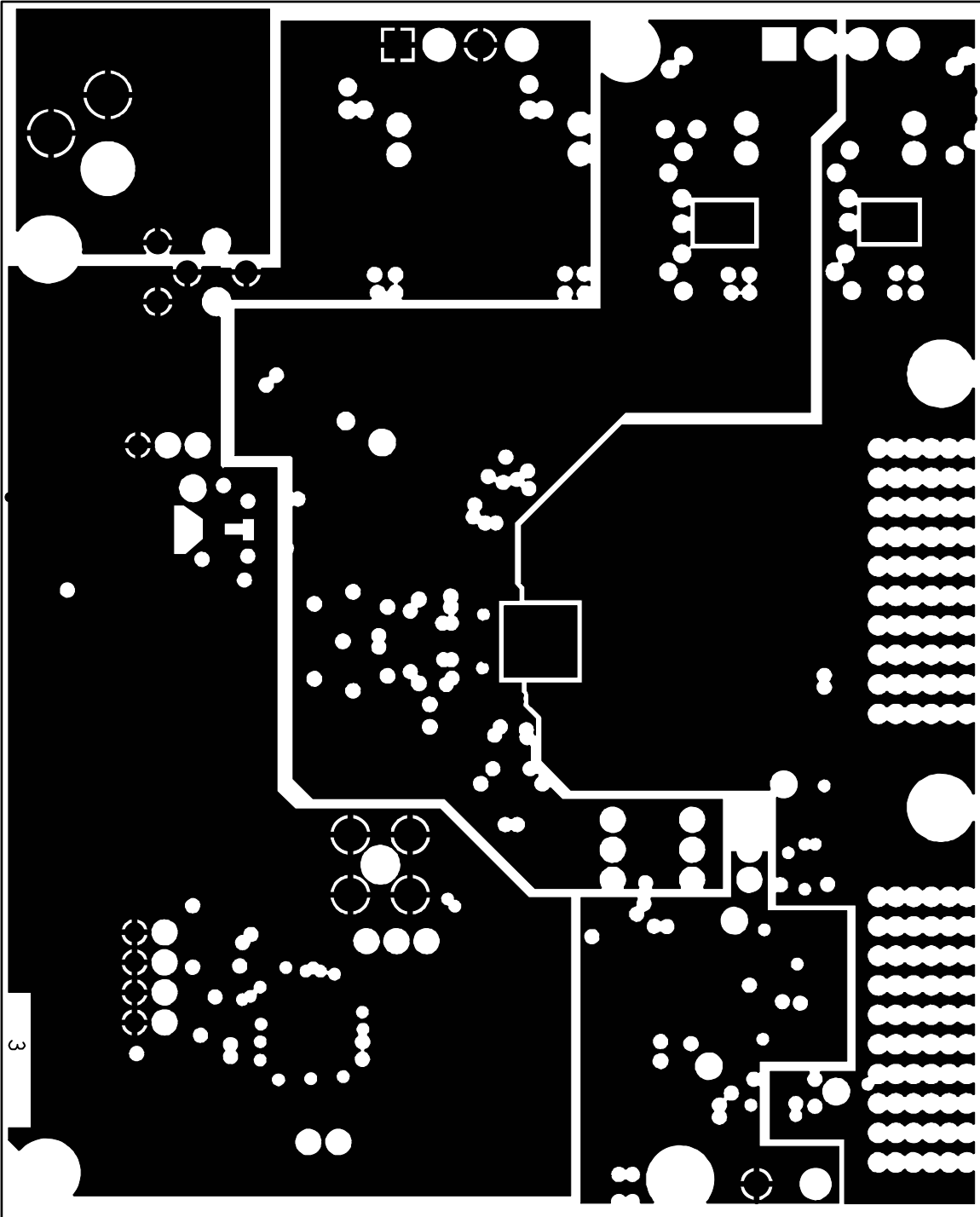


Figure 24. Power Plane (Layer 3)

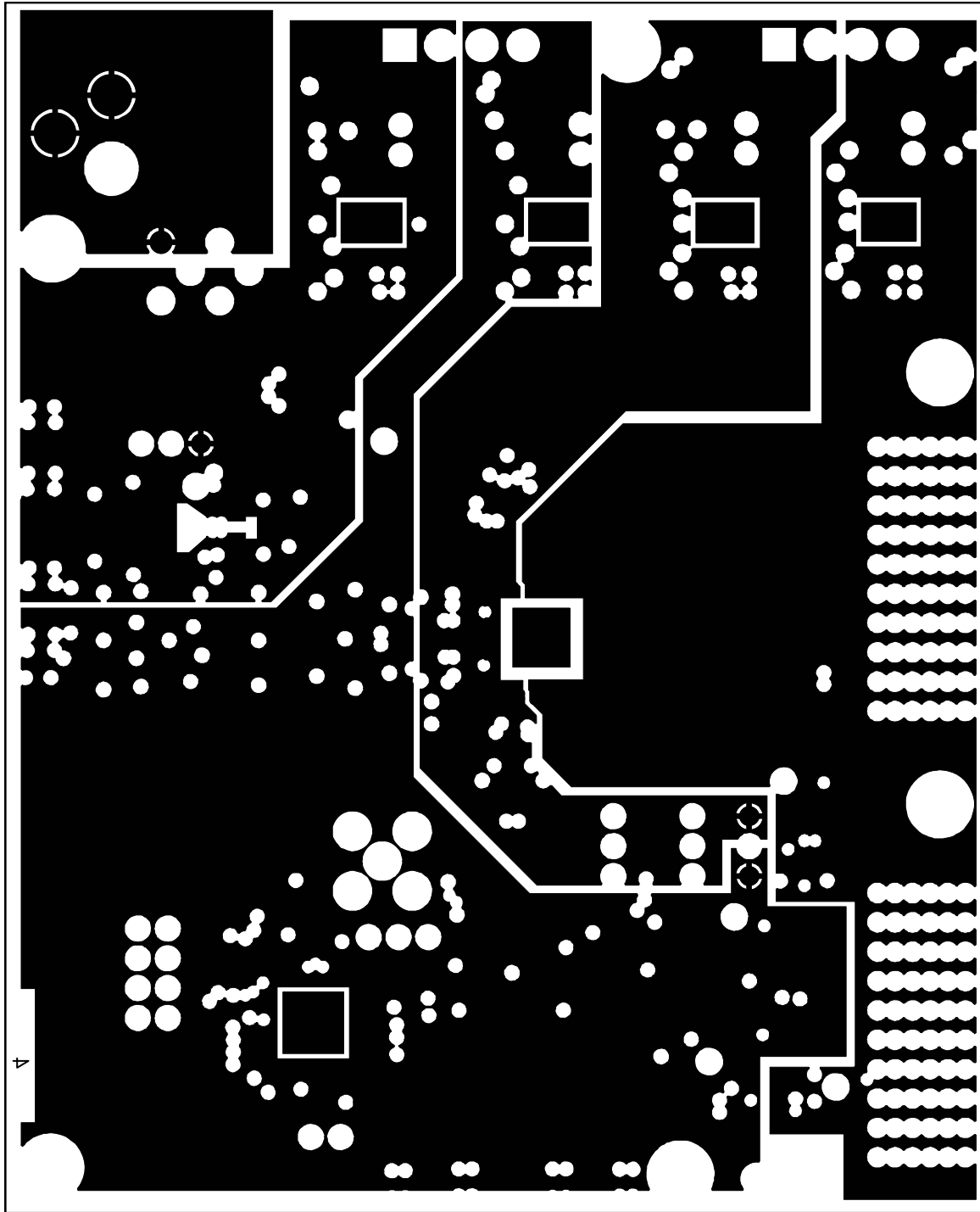


Figure 25. Power Plane (Layer 4)

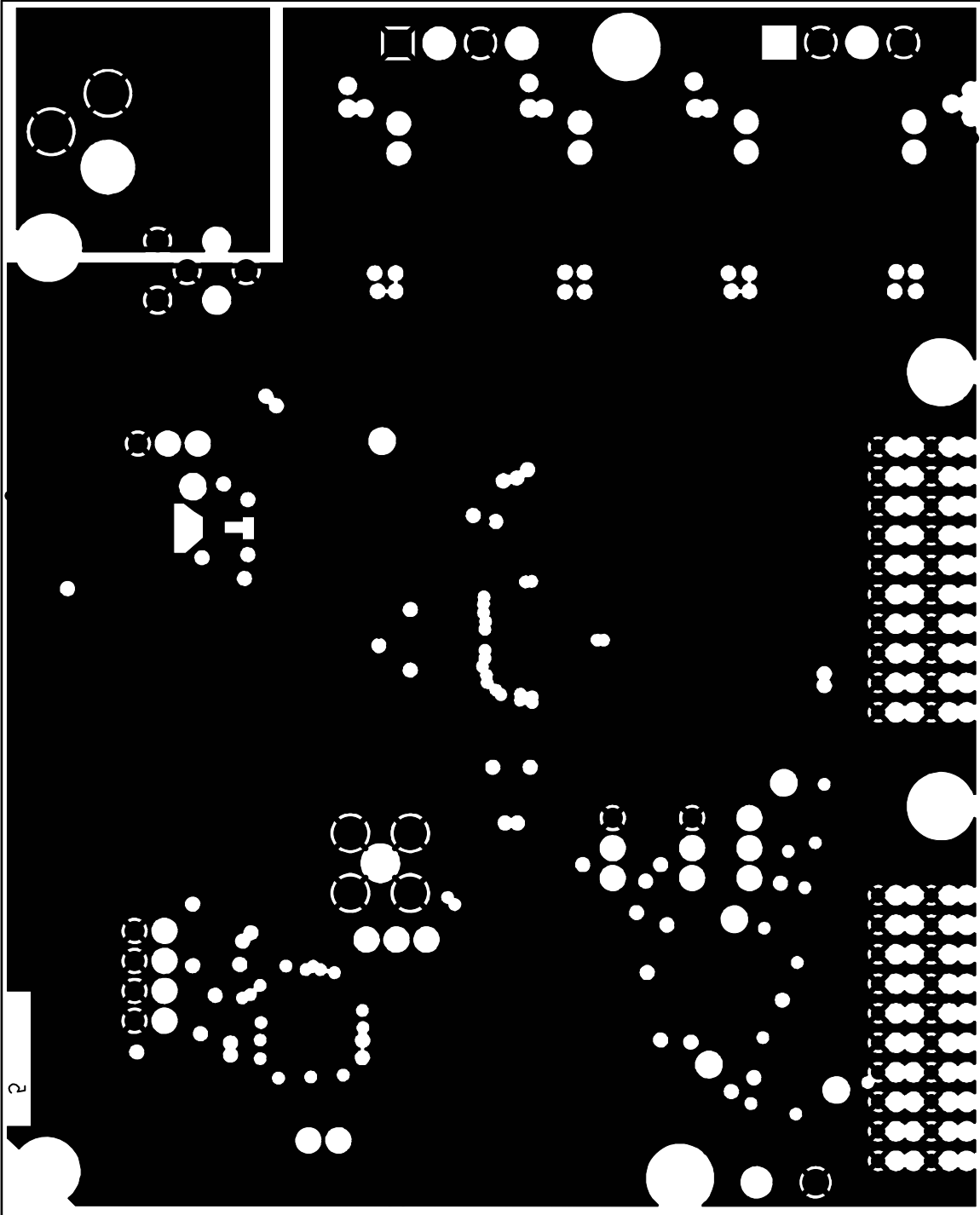


Figure 26. Ground Plane (Layer 5)

099104026

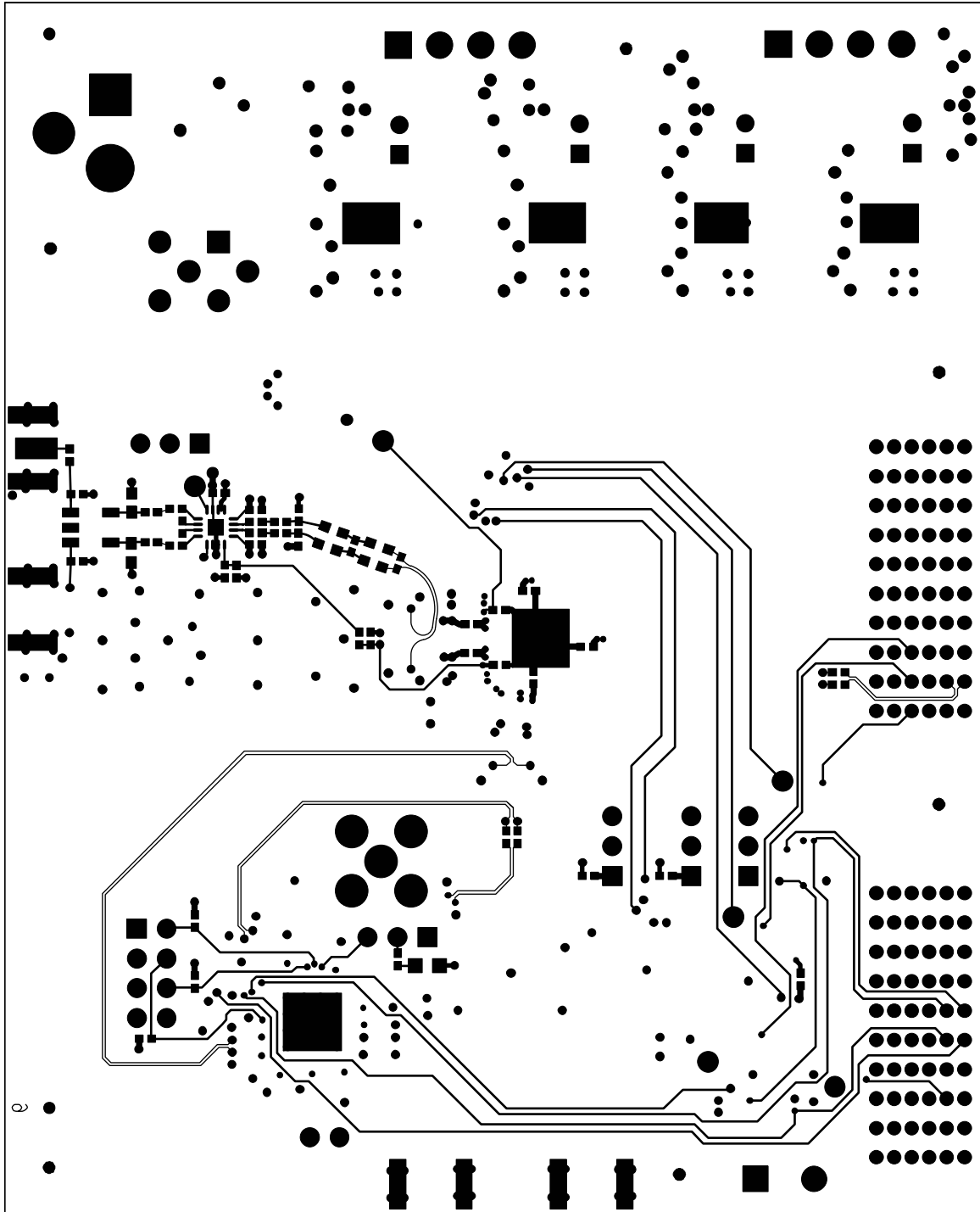


Figure 27. Bottom Side

09810-027

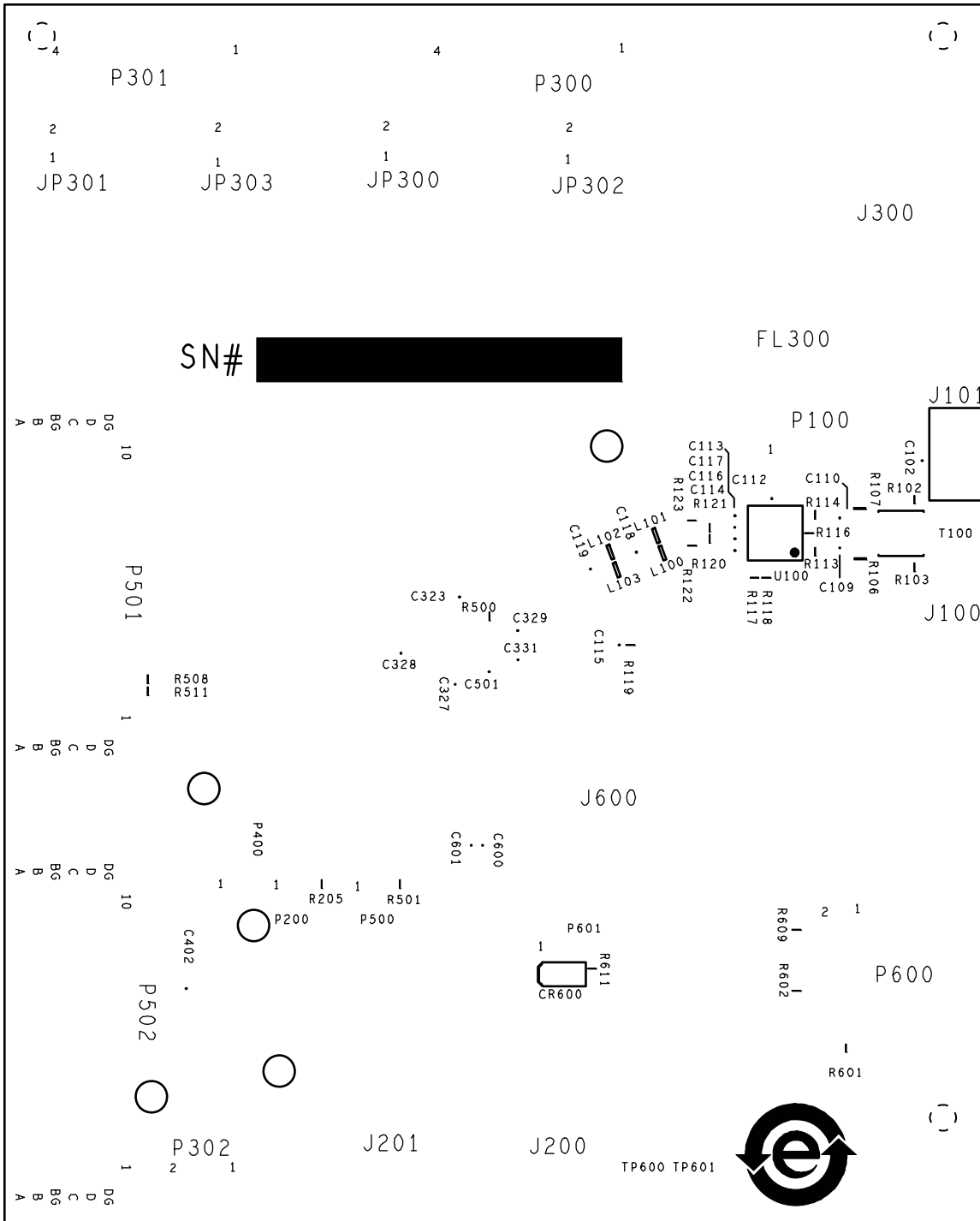


Figure 28. Bottom Silkscreen

06810-028

**ORDERING INFORMATION****BILL OF MATERIALS**

Table 2. AD9434/AD9484 BOM

Qty	Reference Designator	Description	Value	Mfg	Mfg_PN
1	N/A	PCB board, 9434CE01C	0	0	0
32	C100, C103, C105, C106, C108, C115, C200, C201, C202, C204, C205, C316, C317, C318, C319, C320, C321, C322, C323, C324, C325, C326, C327, C328, C329, C330, C331, C332, C333, C400, C401, C501	CAP CER X7R 0402	0.1 $\mu$ F	Murata	GRM155R71C104KA88D
1	C111	CAP High Q microwave chip NPO 0402	4.7 pF	Panasonic	ECD-G0E4R7C
8	C300, C301, C302, C303, C308, C309, C310, C311	CAP CER chip	4.7 $\mu$ F	Panasonic	ECJ-1VB0J475M
3	C304, C305, C306	CAP CER chip X8R	0.01 $\mu$ F	TDK	C1005X8R1E103K
5	C307, C312, C313, C314, C315	CAP CER monolithic	10 $\mu$ F	Murata	GRM21BR61C106KE15L
1	C605	CAP CER chip	0.22 $\mu$ F	Panasonic	ECJ-0EB0J224K
1	CR200	Diode SHTKY dual series	HSMS-2812BLK	Avago	HSMS-2812BLK
5	CR300, CR301, CR303, R304, CR305	Diode recovery rectifier	S2A-TP	Micro Commercial Components Corp	S2A-TP
1	CR302	LED green surface mount	LNJ314G8TRA (green)	Panasonic	LNJ314G8TRA
4	E300, E301, E302, E303	Inductor ferrite beads	50 $\Omega$	Murata	BLM31PG500SN1L
1	F300	Slim line lead-free 1206	2 A	Littelfuse	0466002.NR
1	FL300	FLTR noise suppression LC combined type	BNX016-01	Murata	BNX016-01
3	J100, J200, J201	CONN-PCB SMA ST edge mount	SMA-J-P-X-ST-EM1	SAMTEC	SMA-J-P-X-ST-EM1
1	J300	CONN-PCB powerjack MINI 0.08 IN. R/A T/H	RAPC722X	Switchcraft	RAPC722X
4	JP300, JP301, JP302, JP303	CONN-PCB Berg JMPR ST male 2P	BERG69157-102	Berg	69157-102
3	P200, P400, P500	CONN-PCB Berg HDR ST male 3P	SAMTECTSW10608GS3PIN	Samtec	TSW-103-08-G-S
2	P300, P301	CONN-PCB, pluggable header	Z5.531.3425.0	Wieland	Z5.531.3425.0
1	P302	CONN-PCB term strip header 2P	Z5.530.3225.0	Wieland	Z5.530.3225.0
2	P501, P502	CONN_PCB 60PIN RA connector	6469169-1	Tyco	6469169-1
15	R101, R104, R105, R119,	RES film SMD 0402	0	Panasonic	ERJ-2GE0R00X

Qty	Reference Designator	Description	Value	Mfg	Mfg_PN
	R202, R203, R204, R207, R208, R211, R213, R214, R215, R509, R510				
4	R108, R109, R110, R111	RES film SMD 0402	33	Panasonic	ERJ-2GEJ330X
2	R200, R201	RES film SMD 0402	51	Panasonic	ERJ-2GEJ510X
4	R205, R501, R502, R503	RES ultra-prec ultra-reliability MF chip	1 K	Susumu	RG1005P-102-B-T5
1	R212	RES prec thick film chip R0201	100	Panasonic	ERJ-1GEF1000C
4	R300, R400, R401, R402	RES prec thick film chip R0402	10 K	Panasonic	ERJ-2RKF1002X
1	R301	RES prec thick film chip R0402	1.91 K	Panasonic	ERJ-2RKF1911X
1	R302	RES film SMD 0402	249	Venkel	CR0402-16W-2490FT
3	R403, R406, R408	RES prec thick film chip R0402	100 K	Panasonic	ERJ-2RKF1003X
3	R404, R405, R407	RES film SMD 0402	1.1 K	Panasonic	ERJ-2GEJ112X
3	R409, R412, R414	RES thick film chip	0	Multicomp	0402WGF0000TCE
2	R506, R507	RES chip SMD 0201	0	Panasonic	ERJ-1GE0R00C
1	R603	RES prec thick film chip R0402	200	Panasonic	ERJ-2RKF2000X
4	RN500, RN501, RN502, RN503	RES NTWRK 16-pinIN/8RES surface mount	47	Panasonic	EXB-2HV470JV
3	T102, T103, T200	XFMR RF 1:1	ETC1-1-13	Macom	ETC1-1-13
1	U300	IC-ADI low dropout CMOS LIN REG	ADP1706ARDZ-3.3-R7	Analog Devices	ADP1706ARDZ-3.3-R7
2	U301, U302	IC-ADI low dropout CMOS LIN REG	ADP1706ARDZ-1.8-R7	Analog Devices	ADP1706ARDZ-1.8-R7
1	U303	IC-ADI low dropout CMOS LIN REG	ADP1708ARDZ-R7	Analog Devices	ADP1708ARDZ-R7
1	U401	IC tiny logic UHS dual buffer	NC7WZ16P6X	Fairchild	NC7WZ16P6X
1	U402	IC tiny logic UHS dual buffer	NC7WZ07P6X	Fairchild	NC7WZ07P6X
1	U501	IC-ADI 12-BIT 1.8V ADC converter	0	Analog Devices	0
1	U600	IC-ADI 12-output CLK GEN with INT 1.6GHZ VCO	AD9517-4BCPZ	Analog Devices	AD9517-4BCPZ
38	C101, C102, C104, C107, C109, C110, C112, C113, C114, C116, C117, C118, C119, C203, C206, C207, C208, C402, C500, C502, C600, C601, C606, C607, C608, C609, C610, C611, C612, C613, C614, C615, C616, C617, C618, C619, C620, C621	CAP CER X7R 0402	0.1 $\mu$ F	Murata	GRM155R71C104KA88D
1	C602	CAP CER chip	1800 pF	Panasonic	ECJ-0EB1E182K
1	C603	CAP CER	0.033 $\mu$ F	Panasonic	0402YD333KAT2A



Qty	Reference Designator	Description	Value	Mfg	Mfg_PN
1	C604	CAP CER chip	1500 pF	Panasonic	ECJ-0EB1H152K
1	CR600	LED red surface mount	SML-LXT0805IW-TR	Lumex	SML-LXT0805IW-TR
1	J101	CONN-PCB SMA ST edge mount	SMA-J-P-X-ST-EM1	Samtec	SMA-J-P-X-ST-EM1
1	J600	CONN-PCB coax SMA ST	JOHNSON142-0701-201	Johnson	142-0701-201
4	L100, L101, L102, L103	Inductor SM	10 nH	Panasonic	ELJ-RE10NGF2
2	P100, P601	CONN-PCB Berg HDR ST male 3P	SAMTECTSW10608GS3PIN	Samtec	TSW-103-08-G-S
1	P600	CONN-PCB header 8-pin double row	TSW-104-08-T-D	Samtec	TSW-104-08-T-D
1	R100	RES film SMD 0402	51	Panasonic	ERJ-2GEJ510X
13	R102, R103, R112, R115, R209, R210, R504, R508, R511, R600, R606, R608, R610	RES film SMD 0402	0	Panasonic	ERJ-2GE0R00X
2	R106, R107	RES Vishay high precision SMD 0603	25	Vishay	P0603E25R0BNT
2	R113, R114	RES prec thick film chip R0402	200	Panasonic	ERJ-2RKF2000X
1	R116	Do not install (TBD_R0402)	TBD0402	TBD0402	TBD0402
5	R117, R118, R206, R411, R500	RES prec thick film chip R0402	10 K	Panasonic	ERJ-2RKF1002X
2	R120, R121	RES film SMD 0402	39	Panasonic	ERJ-2GEJ390X
2	R122, R123	RES film SMD 0402	100	Susumu	RG1005P-101-B-T5
3	R410, R413, R415	RES thick film chip	0	Multicomp	0402WGF0000TCE
14	R505, R512, R513, R514, R515, R516, R517, R518, R519, R520, R521, R522, R523, R524	RES prec thick film chip R0201	100	Panasonic	ERJ-1GEF1000C
5	R601, R602, R604, R607, R609	RES prec thick film chip R0402	1.00 K	Panasonic	ERJ-2RKF1001X
2	R605, R612	RES film SMD 0402	100	Venkel	CR0402-16W-1000FPT
3	R611, R615, R616	RES film SMD 0402	249	Venkel	CR0402-16W-2490FT
1	R613	RES prec thick film chip R0402	5.11 K	Panasonic	ERJ-2RKF5111X
1	R614	RES prec thick film chip R0402	4.12 K	Panasonic	ERJ-2RKF4121X
1	T100	XFMR RF 1:1	ETC1-1-13	Macom	ETC1-1-13
2	T101, T201	XFMR RF	ADT1-1WT	Mini-Circuits®	ADT1-1WT
6	TP100, TP400, TP401, TP402, TP403, TP500	CONN-PCB pin receptacle	3102-3-00-15-00-00-08-0	Mill-Max	3102-3-00-15-00-00-08-0
2	TP600, TP601	CONN-PCB pin vector	K24A	Vector	K24A

Qty	Reference Designator	Description	Value	Mfg	Mfg_PN
1	U100	IC-ADI low dist ultra-high-spd diff ADC drvr	ADA4960_PRELIM	Analog Devices	ADA4960_PRELIM
2	U200, U400	IC-ADI CMOS, quad SPDT switches	ADG734BRUZ	Analog Devices	ADG734BRUZ
1	U500	Precision series sub-band gap voltage ref	ADR130AUJZ	Analog Devices	ADR130AUJZ

**NOTES**

## NOTES

**ESD Caution**

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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