AFE5804EVM

The AFE5804EVM is an evaluation tool designed for the ultrasound analog front-end (AFE) device AFE5804. In order to deserialize the outputs of the AFE5804, use of the ADSDeSer-50EVM during evaluation is also recommended.

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1 Introduction

The AFE5804 includes an 8-channel, voltage-controlled amplifier (VCA) and an 8-channel, 50-MSPS analog-to-digital converter (ADC). The outputs of the ADC are 8-channel LVDS outputs, which can be deserialized by the ADSDeSer-50EVM. The AFE5804 evaluation module (EVM) provides an easy way to examine the performance and functionalities of AFE5804.

1.1 Features

- Characterizes the AFE5804
- Supports CW functionalities test
- Provides 8-channel, low-voltage differential signal (LVDS) outputs from the ADC
- Compatible with the standard TI LVDS deserializer ADSDeSer-50EVM
- Communicates with a personal computer (PC) through a USB interface
- RS-232 interface also can be configured in case users wish to control the AFE5804 with a microcontroller. MSP430 programming is required.
- Includes multiple power management solutions for the AFE5804 and other devices.
- Onboard Vcntl generator (0 V - 1.2 V).

1.2 Power Supplies

The AFE5804EVM requires only ±5-V power supplies for operation.

1.3 Indicators

The AFE5804EVM has four LEDs onboard as shown in Figure 1. The states of these LEDs demonstrate the normal operation of the AFE5804EVM.

- LED1, LED2: +3.3-VA and +3.3-VD power supply indicators. They show the normal operation of 3.3-V power regulators.
- LED 3: MCU operation indicator. Flashing state can indicate the normal operation of the MSP430 when the MSP430 is appropriately programmed.
- LED 4: 1.8-V power indicators

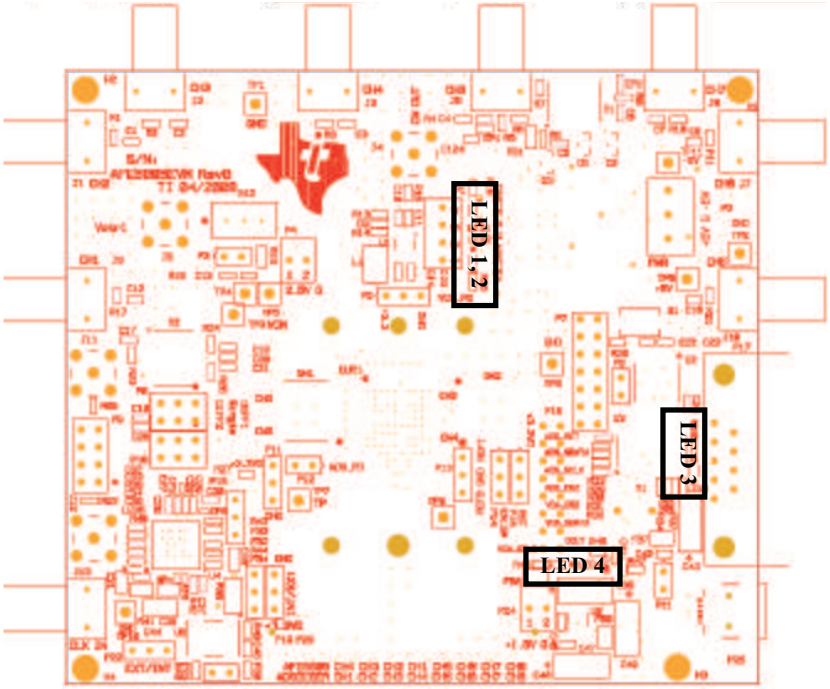


Figure 1. AFE5804EVM LED Locations

2 Board Configuration

This section describes in detail the locations and functionalities of inputs, outputs, jumpers, and test points of the AFE5804EVM.

2.1 I/O and Power Connectors

Pin A1 of the AFE5804 is marked by a white dot on its package as well as a white dot on the board. The positions and functions of the AFE5804EVM connectors are discussed in this section.

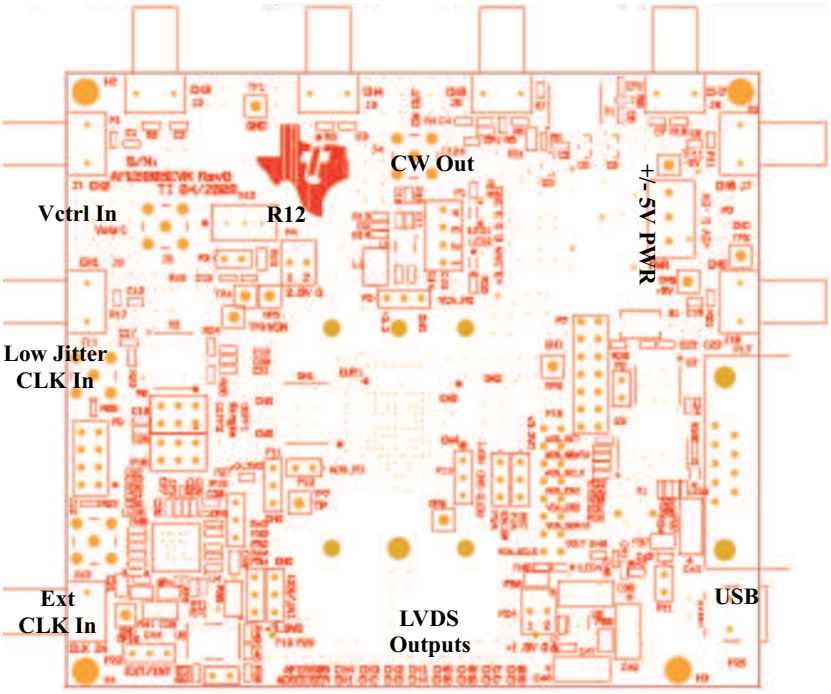


Figure 2. AFE5804EVM I/O Connectors and Locations

- Analog Inputs Ch1-Ch8 (J1-J3, J5-J7, J9, J10): Single-ended analog signal inputs with 50-Ω termination and AC-coupling
- CW Output (J4): CW output after I/V translator
- Vcntl Input (J8 optional): VCA gain control voltage of AFE5804, 0 V to 1.2 V, when this SMA connector is used, shunt P3 must be removed. .
- Low-Jitter CLK Source Input (J11): This input accepts clocks with low-jitter noise, such as HP8644 output. 20- to 50-MHz, 50% duty-cycle clock with 1- to 2-Vrms amplitude can be used. When J11 is used, ensure that shunts P18, P23, and P22 are removed.
- External CLK Input (J13): ADC Clock input, such as FPGA outputs. However, the AFE5804 does not achieve satisfactory performances due to the high-jitter noise of the clock.
- ±5-V PWR connector (P2): Power supply input
- Regulated power supply outputs (P1, P4, and P24): 3.3-VA, 3.3-VD, 2.5-VA, 1.8-VD outputs. Connectors need to be installed.
- RS-232 Input (P17): PC serial port interface for setting AFE5804
- USB input (P25): USB interface to control the AFE5804 (default)
- LVDS Outputs Ch1-Ch8 (P26): Differential LVDS data outputs
- R12 is used to adjust the onboard Vcntl from 0 V to 1.2 V. P3 must be shorted when onboard Vcntl is used.

2.2 Jumpers and Setup

In the following detailed description, the board has been set to default mode (see Figure 3).

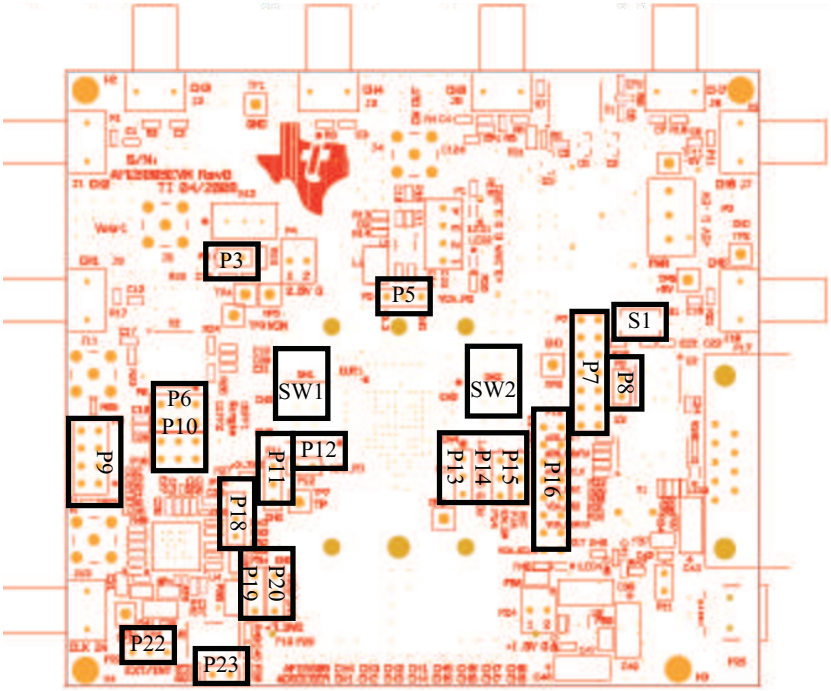


Figure 3. Locations of Jumpers, JTAG, and Switches on the AFE5804EVM

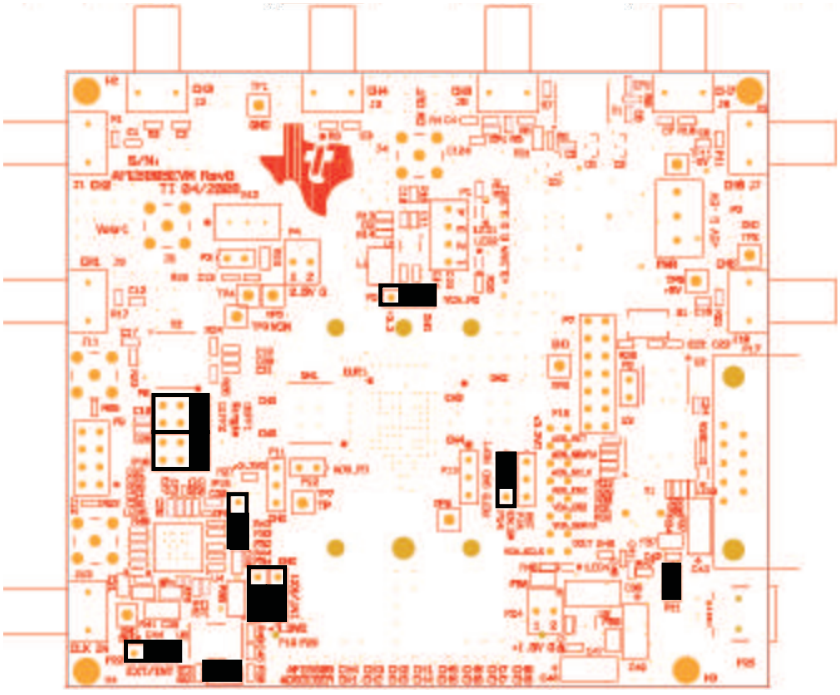


Figure 4. Default Setup for Jumpers

- P5: Power-down pin for the VCA section of the AFE5804. Grounded (default mode) or High (+3.3 VD) for power-down mode.
- P6, P10: AFE5804 ADC clock input selection: Transformer-based differential clock, single-ended LVCMOS clock, or future clock option (needs U4 for support). The default mode uses the

transformer-based differential clock.

- P7: MSP430 microcontroller JTAG interface
- P8: MAX3221 (RS-232) power-off jumper. When the jumper is removed, MAX3221 is completely powered off. In the default mode, the jumper is uninstalled because the USB interface is used.
- P9: SPI™ interface for U4.
- P11: TI internal use. Default is floating.
- P12: Power-down pin for ADS. Active High (+3.3 VD). Floating for default mode.
- P13: External ADS reference voltage inputs. Floating in the internal reference mode.
- P14: EN_SM: In the default mode, P14 connects to +3.3 VD, and the state machine is enabled. The AFE5804 is operated using only one SPI port (ADS SPI port).
- P15: RST pin; connects to H4 in the default mode through 0-Ω resistors.
- P16: Debug port for monitoring VCA and ADS SPI signals.
- P19: TI internal use. Connects to 3.3 VD.
- P20: INT/EXT reference mode selection. +3.3 VD for the internal reference mode (default); GND for the external reference mode.
- P22: Uses onboard 40-MHz clock or external clock through J13. The default mode uses the onboard clock
- P23: Power-on onboard 40-MHz clock generator. Default is on.
- P18: Because U4 is uninstalled, this jumper must be set as Figure 4 shows
- S1: MSP430 reset button
- SW1, SW2: CW outputs summation switch. Individual CW output current can be summed through the I/V translator U1 when its corresponding switch is set to ON.

2.3 Test Points

Multiple test points are provided on the EVM. Detail descriptions follow. Under normal operation mode, it is unnecessary to measure voltages at most of these test points.

- TP1: GND
- TP2: GND
- TP3: VCM
- TP4: Vcntl test point
- TP5: GND
- TP6: GND
- TP7: Test point, TI internal only
- TP8: +5 V
- TP9: CM
- TP10:GND
- TP11: -5 V

3 Board Operation

This section describes how to operate the AFE5804EVM for evaluation purposes. Both software and hardware installation and operation are discussed.

3.1 Software Installation and Operation

The AFE5804EVM ships with the AFE5804EVM USB SPI software and AFE58XXEVM driver. Run the AFE58XXEVM Driver install.exe and the setup.exe to install the driver and software, respectively. The personal computer (PC) recognizes the EVM after software installation.

To launch the software after successful installation, click:
Start Menu → All Programs → Texas Instruments → AFE5804EVM USB SPI → AFE5804EVM USB SPI

Three different modes are shown in Figure 5, Figure 6, and Figure 7.

The software updates the AFE5804 registers as soon as users change any current setup (i.e., the program sends out new register values due to any value change). It is recommended that users change at least one register value before measurement. Therefore, the register values in a device can be synchronized to the displayed values on the software interface.

In most cases, users only need to change the VCA setup. The ADC setup can remain the same as the integrated circuit (IC) is powered up.

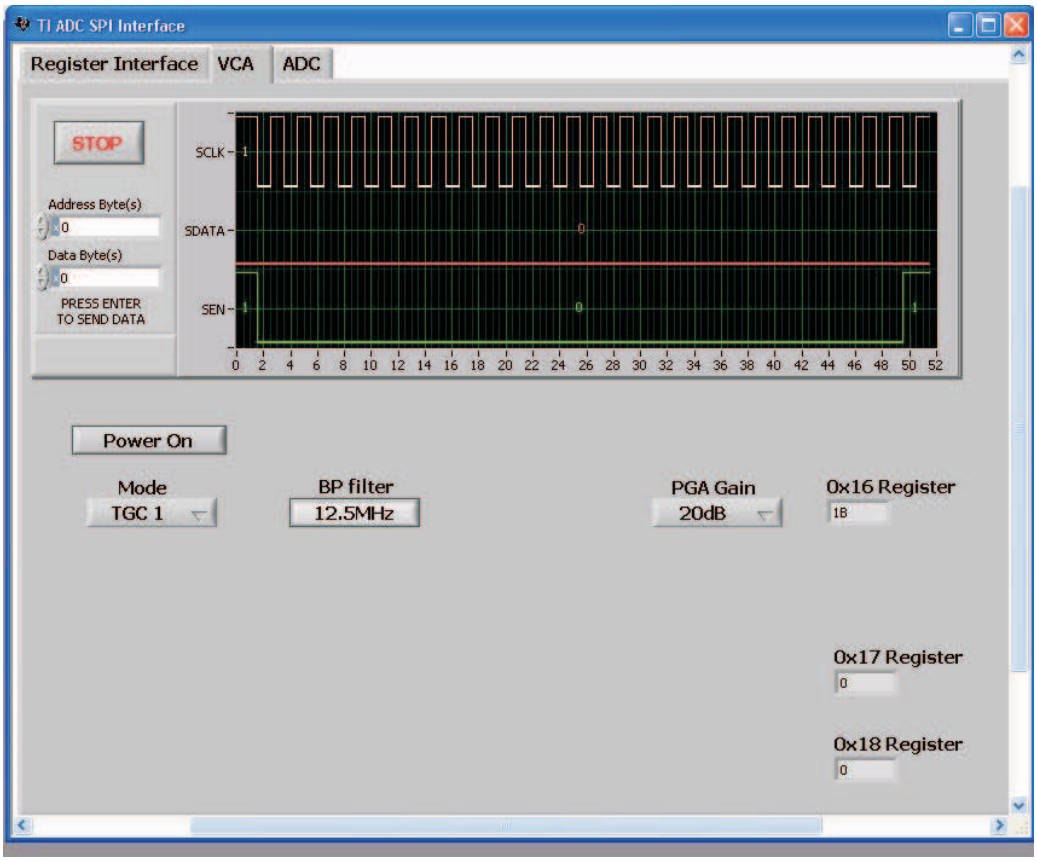


Figure 5. AFE5804EVM USB SPI Interface for TGC Mode

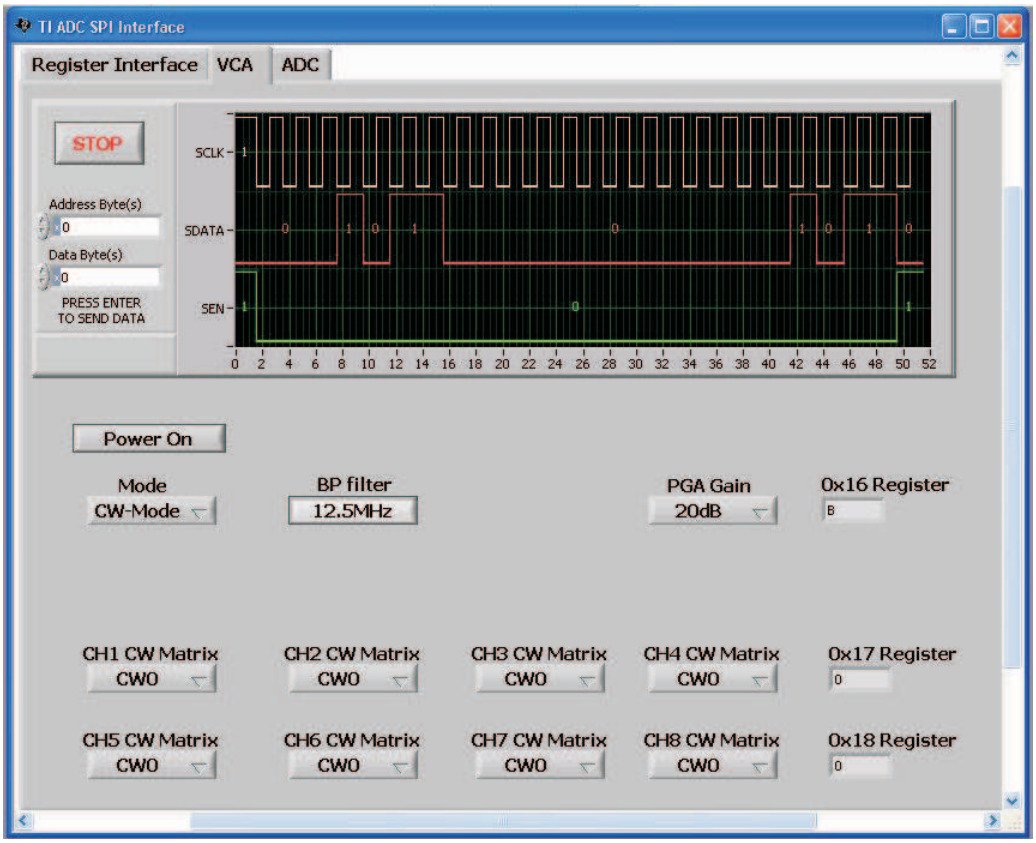


Figure 6. AFE5804EVM USB SPI Interface for CW Mode

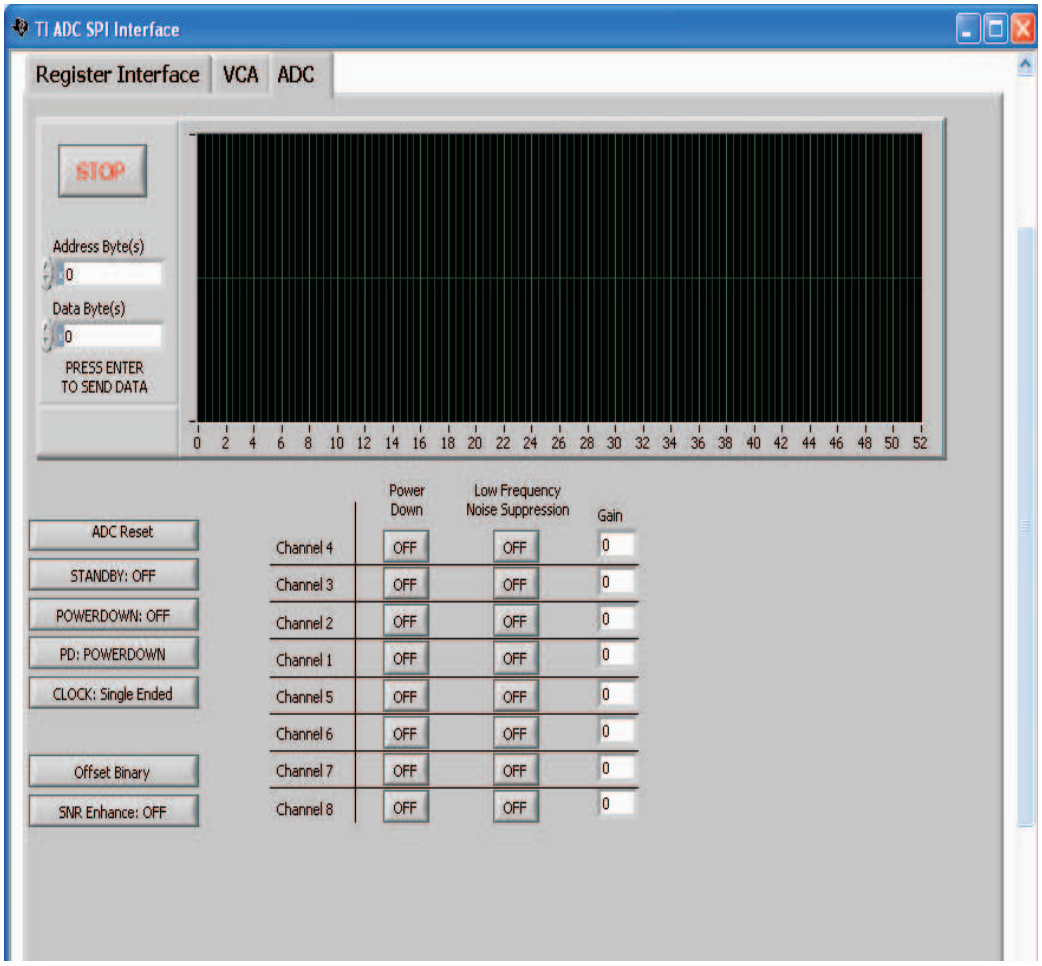


Figure 7. AFE5804EVM USB SPI Interface for ADC Setup

3.2 Hardware Setup

When the AFE5804EVM is powered on in the default mode, the AFE5804 is set as described in Table 1.

Table 1. AFE5804EVM Default Settings When Powered On

VCA	ADS
TGC mode 1	Single End Clock
PGA = 20 dB	Digital Gain = 0
Filter = 17 MHz	Other parameters are as stated in data sheet

Initial measurements can be made under these default settings. See the AFE5804 data sheet (SBOS442) for additional settings.

As previously mentioned, the deserializer ADSDeSER-50EVM is required. See details in the ADSDeSER-50EVM user's guide (SBAU091). An example bench setup is shown in Figure 7. Band-pass filters are required for signal source in order to ensure the correct SNR measurements of the AFE5804.

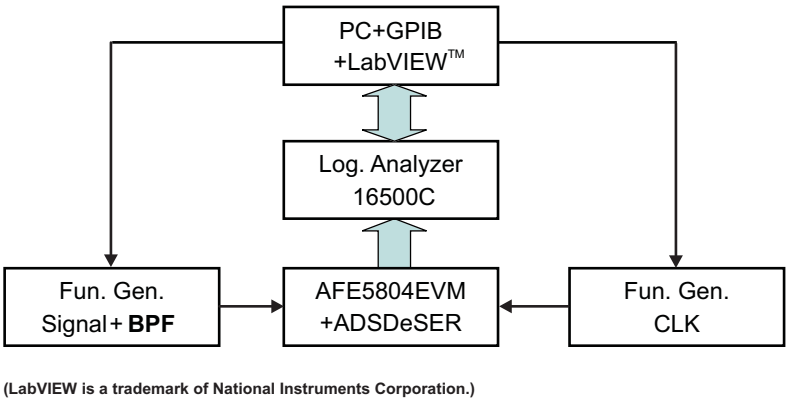


Figure 8. Typical AFE5804 Bench Setup

The channel order of the AFE5804 outputs is not the same as that of the ADS527x outputs. Consequently, the channel number on the ADSDeSER-50EVM or AFE5804EVM can be misleading. Table 1 provides channel-to-channel sequence matching between the ADSDeSER-50EVM and the AFE5804EVM.

Table 2. Channel-to-Channel Matching Between the AFE5804EVM and ADSDeSER-50EVM

AFE5804	FCLK	CH4	CH3	CH2	CH1	CH5	CH6	CH7	CH8	LCLK
ADSDESER	FCLK	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	LCLK

For example, when an analog signal is present on CH1 of the AFE5804EVM, the corresponding 12-bit digital output can be seen on CH4 of the ADSDeSER-50EVM.

3.3 Clock Selection

The AFE5804 can be clocked through a transformer-based differential clock, single-ended clock, or future clock input options provided by U4 as Figure 9 shows.

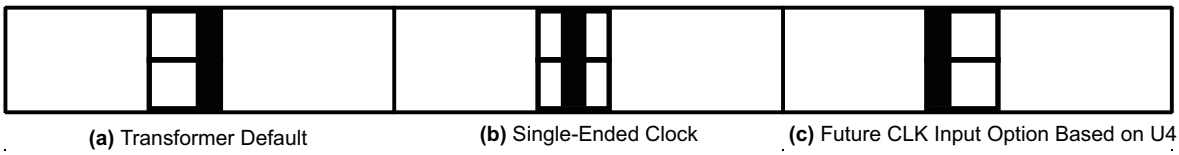


Figure 9. Clock Selection Jumper Configurations

The clock source of the EVM can be the onboard 40-MHz clock, HP8644 low-jitter clock source, or external clock source. The best performance of this EVM is achieved when the low-jitter clock source HP8644 is used. P22, P23, and P18 must be removed in order to disable the onboard clock.

When HP8644 or similar clock sources are unavailable, the onboard 40-MHz clock is the desirable source. The jumpers P22, P23, and P18 must be configured as shown in Figure 4 (i.e., the default setup for AFE5804EVM). In this mode, the transformer-based differential clock is used.

3.4 Data Analysis

Based on the data file acquired by a logic analyzer, the performance of AFE5804 can be evaluated.

Appendix A provides one solution (TI TSW1100 software) to analyze the data file captured by a logic analyzer. Coherent sampling is recommended but is not mandatory. Due to the frequency accuracy requirement of coherence sampling, two HP8644s are required for generating an ADC clock and analog signal. For most users, this may be infeasible. Data analysis based on windowing is a more suitable approach.

4 Schematics and Layout

This section provides the schematics, the AFE5804EVM board layout, and the bill of materials.

4.1 Schematics

The schematics appear at the end of the document.

4.2 PCB Layout

The AFE5804EVM uses a six-layer printed-circuit board. The following figures show each layer.

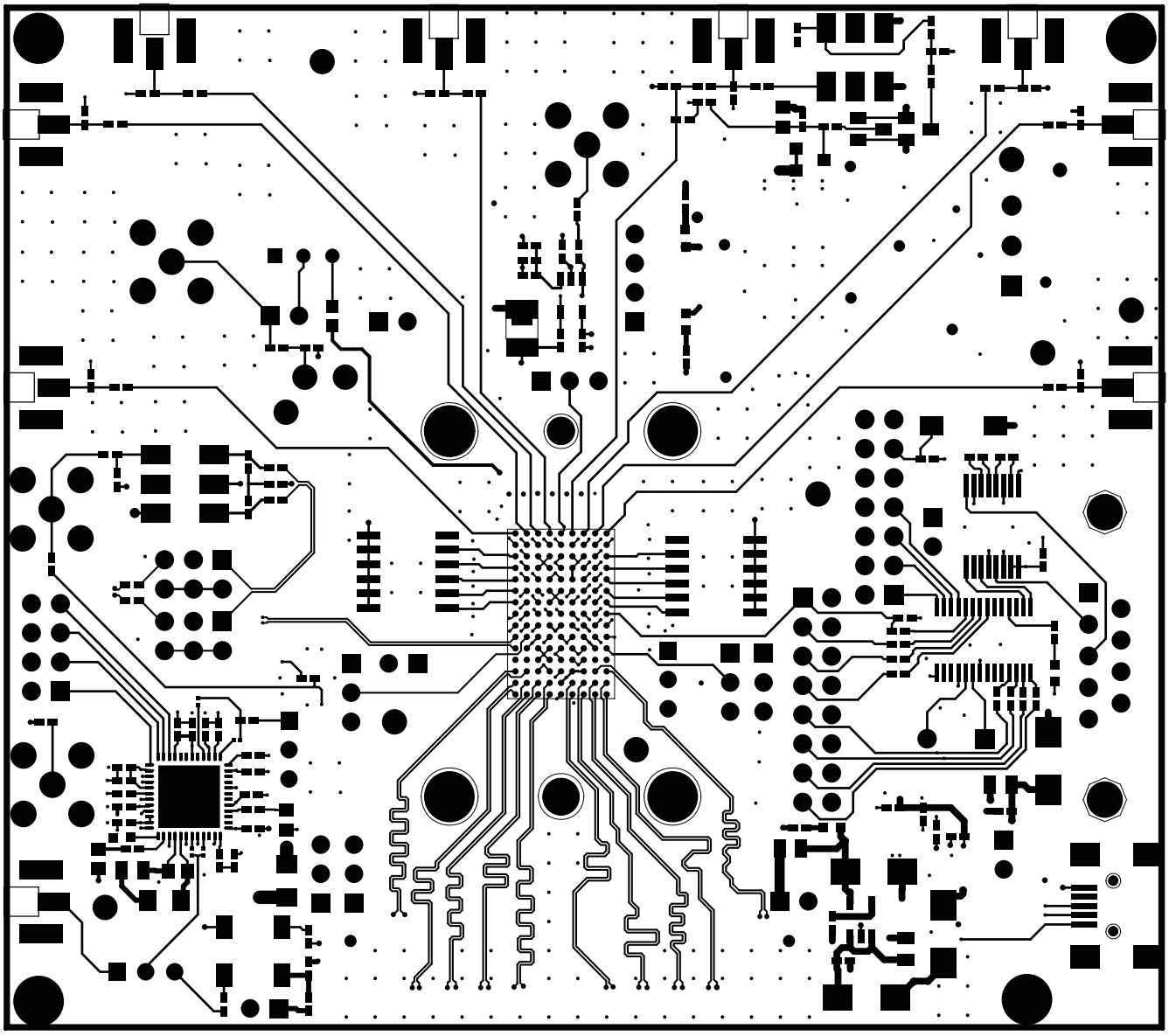


Figure 10. Top Layer, Signal

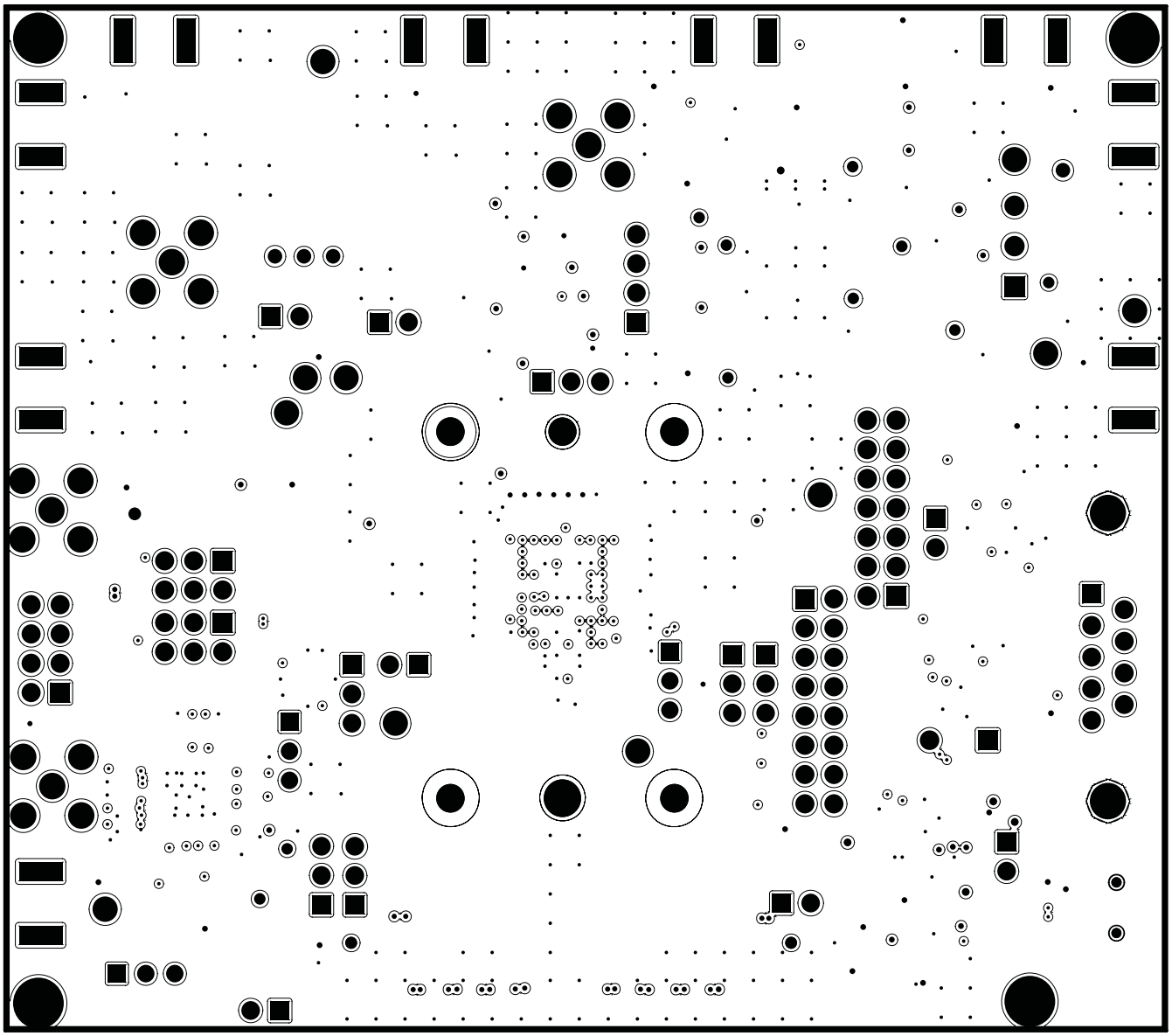


Figure 11. Inner Layer 1, Ground

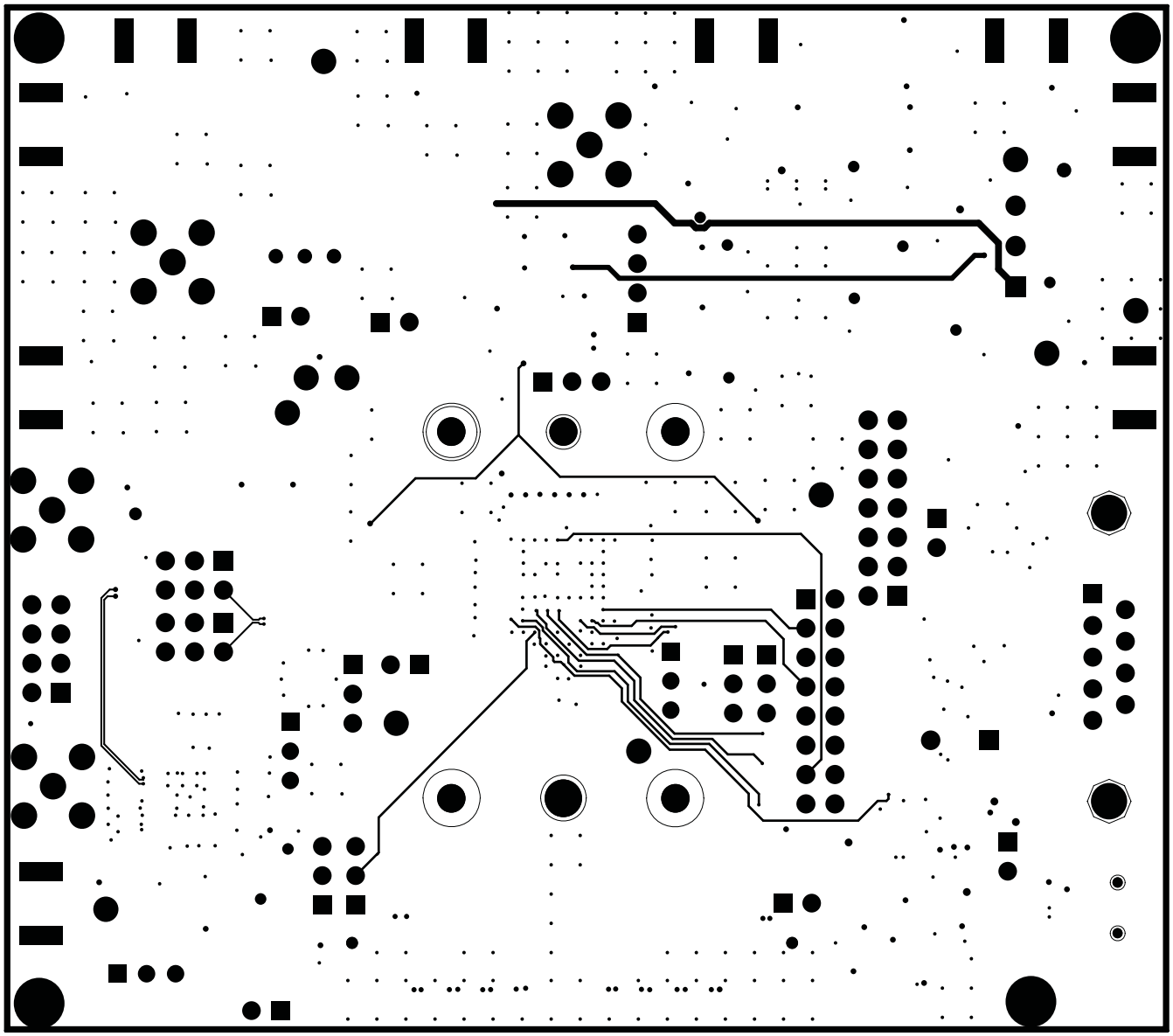


Figure 12. Inner Layer 2, Signal

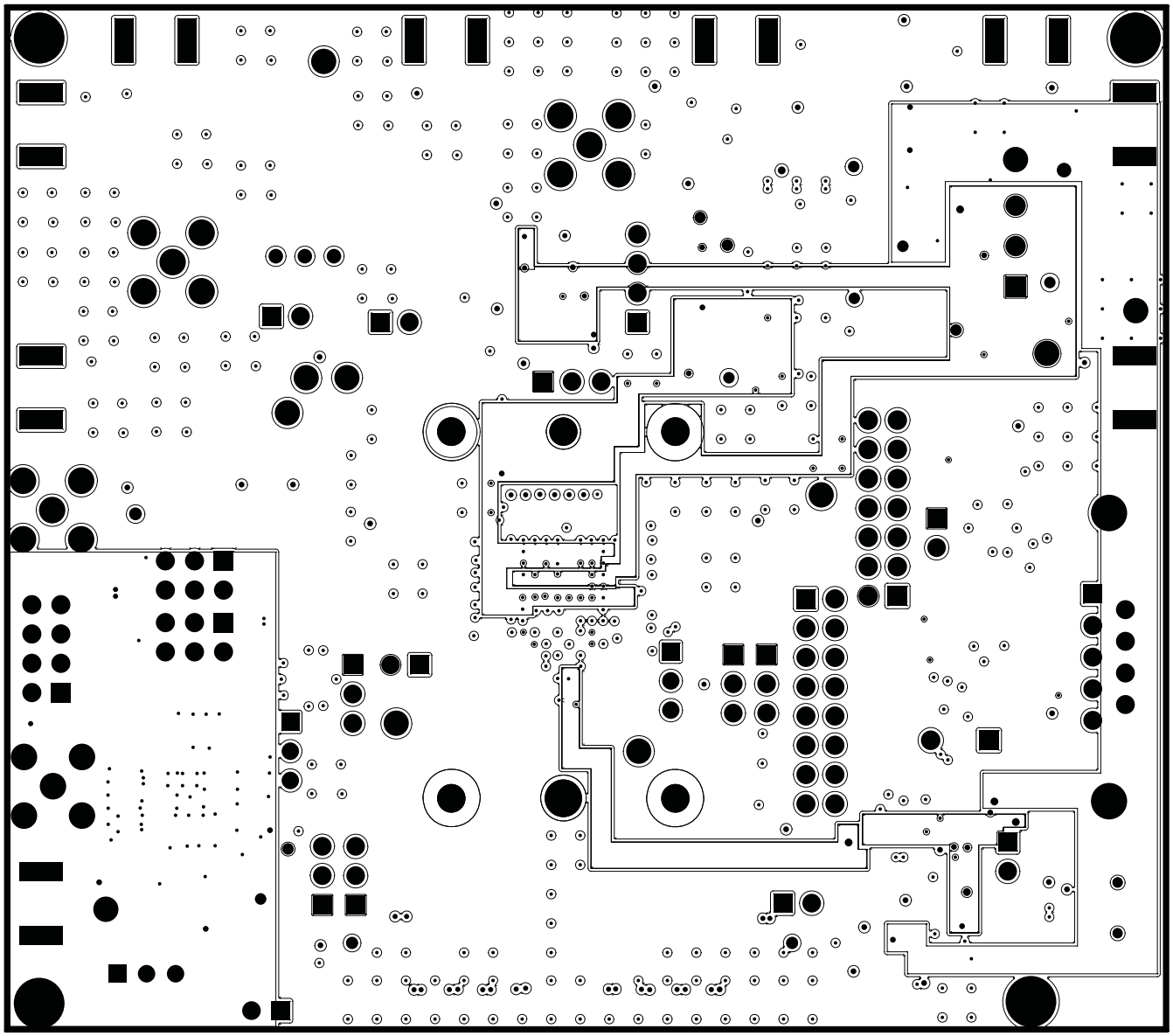


Figure 13. Inner Layer 3, Power

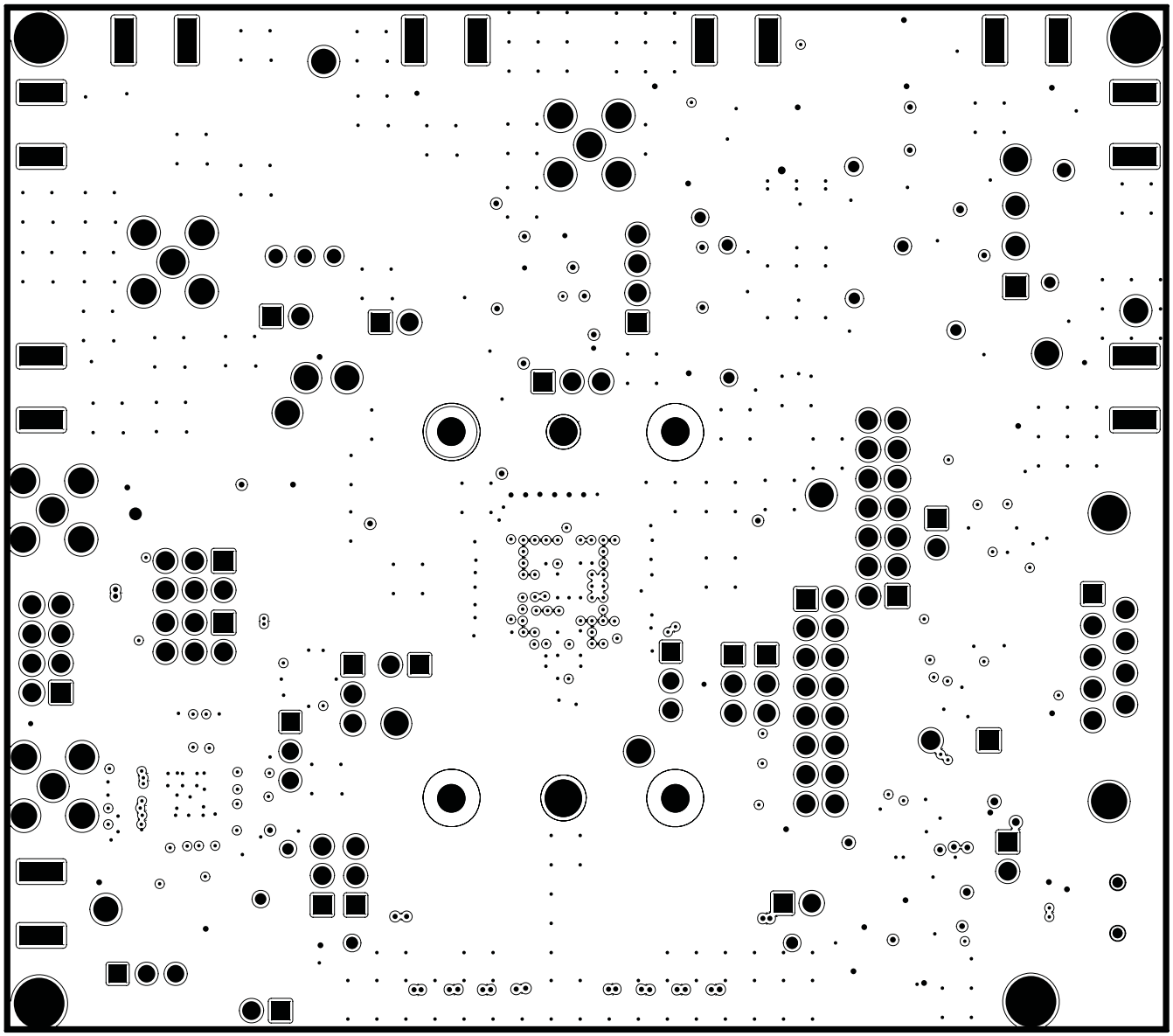


Figure 14. Inner Layer 4, Ground

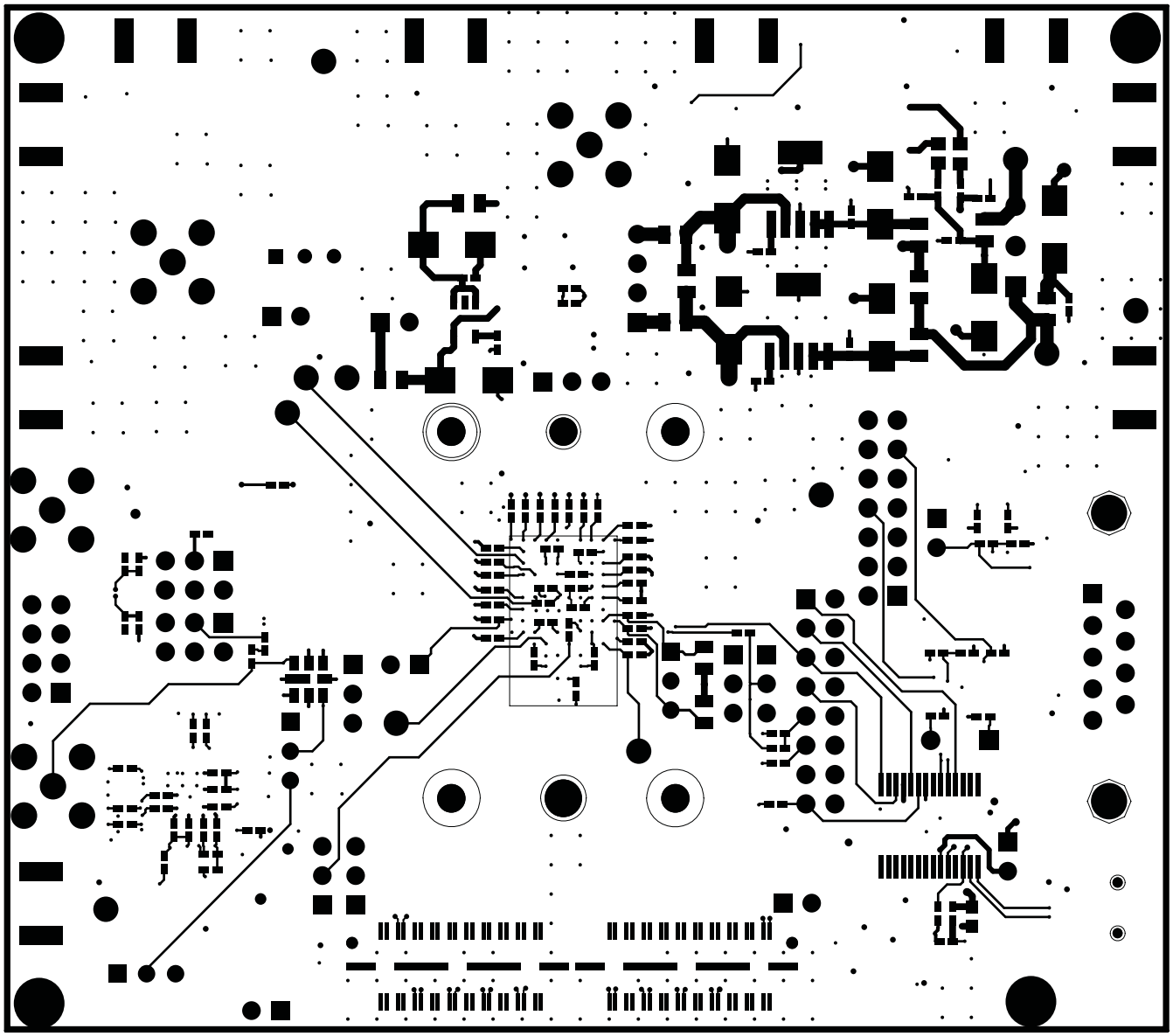


Figure 15. Bottom Layer, Signal

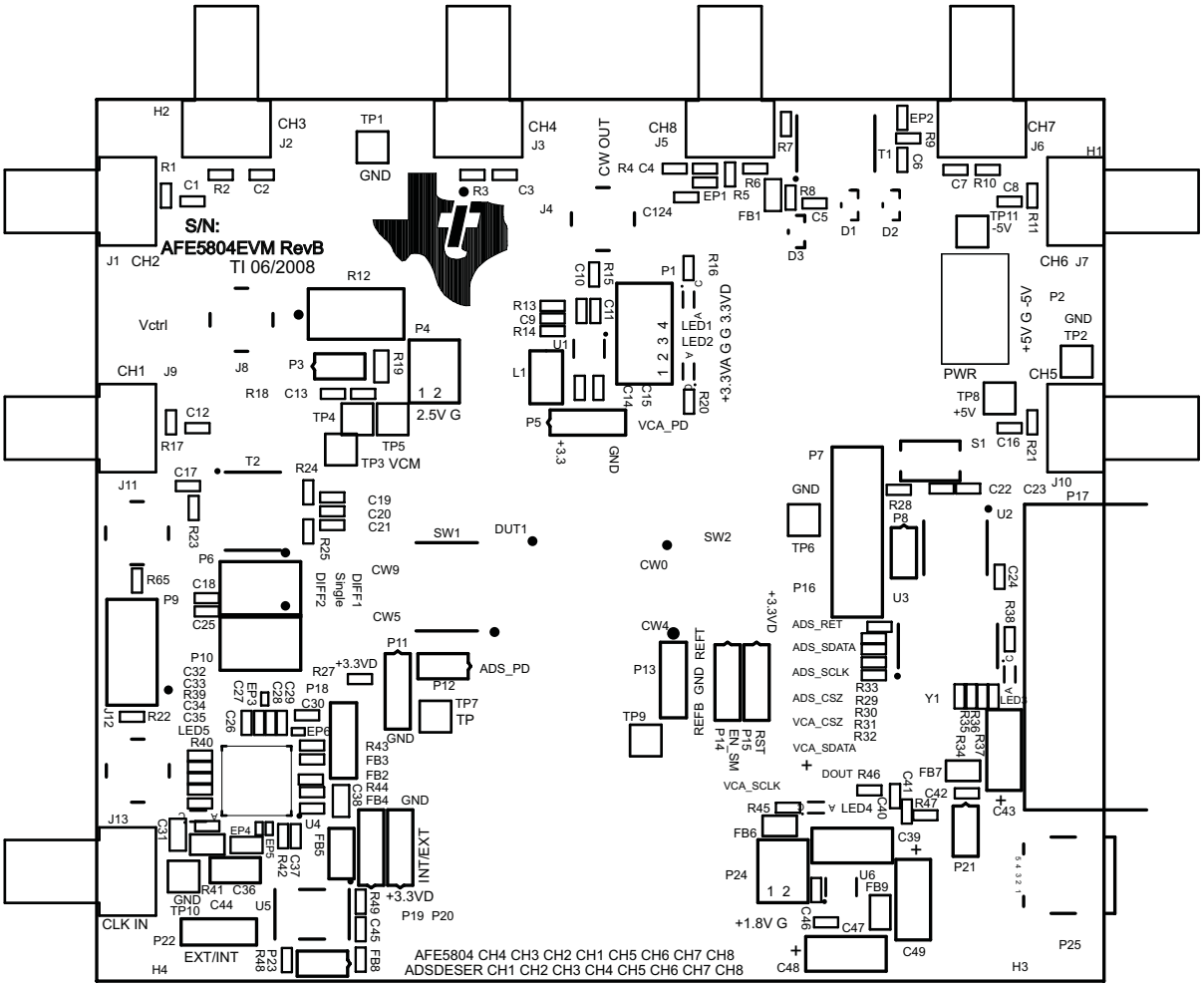


Figure 16. Top Silk Screen Layer

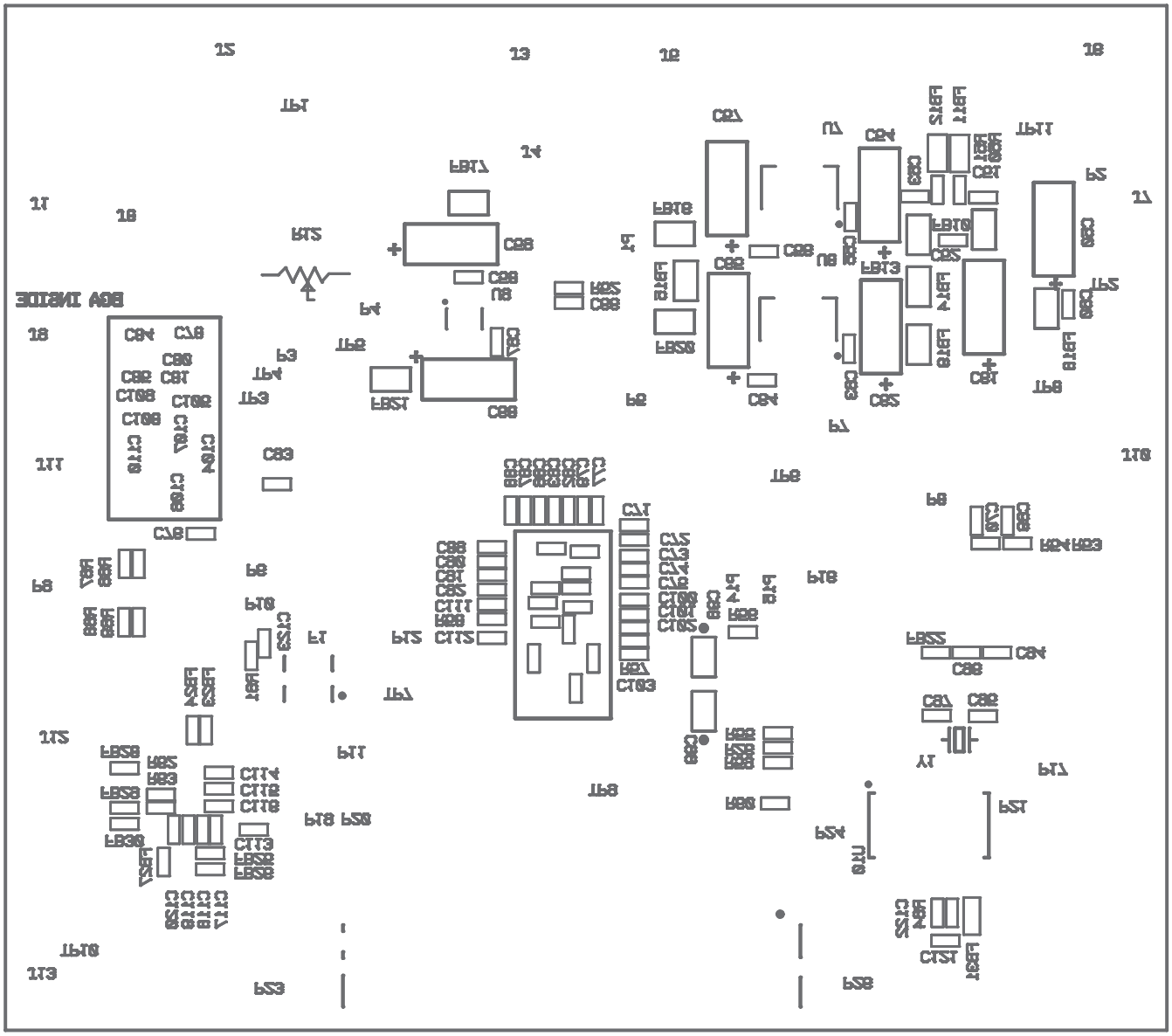


Figure 17. Bottom Silk Screen Layer

4.3 Bill of Materials

Table 3. Bill of Materials

Item	MFG	MFG Part Number	RefDes	Value or Function
1	TI	MSP430F1232IPW	U3	MIXED SIGNAL MICROCONTROLLER
2	KEMET	C0402C103K3RAC	C9	CAPACITOR,SMT,0402,CER,0.01µF,25V,10%,X7R
3	KEMET	C0402C104K8PAC	C1, C2, C3, C4, C5, C6, C7, C8, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C32, C33, C34, C35, C40, C41, C42, C45, C46, C47, C51, C52, C53, C55, C56, C58, C60, C63, C64, C67, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C93, C94, C96, C100, C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C115, C116, C117, C118, C119, C120, C121, C122, C123, C124	CAPACITOR,SMT,0402,CER,0.1µF,10V,10%,X5R
4	PANASONIC	ECJ-0EC1H100D	C66, C95, C97	CAPACITOR,SMT,0402,CER,10pF,50V,±0.5pF,NPO
5	MURATE	GRM155R60J225ME15D	C37, C92	CAPACITOR,SMT,0402,CERAMIC,2.2µF,6.3V,20%,X5R
6	PANASONIC	ECJ-1VB0J475K	C36	CAPACITOR,SMT,0603,CER,4.7µF,6.3V,10%,X5R
7	TAIYO YUDEN	JMK107BJ106MA-T	C31, C38	CAPACITOR,SMT,0603,CER,10µF,6.3V,20%,X5R
8	MURATA	GRM31CR60J476ME19B	C44	CAPACITOR,SMT,CER,1206,47µF,6.3V,20%,X5R
9	AVX	TACR475M020R	C98, C99	CAP,SMT,TAN,0805,4.7µF,20V,20%,R-CASE
10	AVX	TPSC226K016R0375	C39, C43, C48, C49, C50, C54, C57, C59, C61, C62, C65, C68	10%, 16V, 22µF
11	SAMTEC	SMA-J-P-X-ST-EM1	J1, J2, J3, J5, J6, J7, J9, J10, J13	SMA JACK EDGE MOUNT,062PCB,BRASS/GOLD,STRAIGHT,50 Ω
12	SAMTEC	SMA-J-P-H-ST-TH1	J4, J8, J11, J12	SMA COAX STRAIGHT PCB JACK,SMT,175TL,50 Ω,GOLD
13	TYCO ELECTRONICS	745781-4	P17	DSUB, 9 PIN, R/A FEM
14	ADVANCED CONNECTER	MNE20-5K5P10	P25	MINI-AB USB OTG RECEPTACLE R/A SMT TYPE
15	USCC	HC-18/U-4.1943M	Y1	4.194300 MHz
16	EPSON TOYOCOM	HF-372A(UNINSTALLED)	F1	CRYSTAL FILTER UNINSTALLED
17	TI	N/A	U4	(UNINSTALLED)
18	Not Installed	PAD0201(UN)	EP4, EP6	(Uninstalled Part) EMPTY PAD,SMT,0201
19	Not Installed	PAD0402(UN)	EP1, EP2	(Uninstalled Part) EMPTY PAD,SMT,0402
20	MURATA	BLM15BD102SN1D	FB2, FB3, FB4, FB8, FB22, FB23, FB24, FB25, FB26, FB27, FB28, FB29, FB30	FERRITE BEAD,SMT,0402,1 kΩ,200mA
21	MURATA	BLM18EG601SN1D	FB31	FERRITE BEAD,SMT,0603,600 Ω at 100MHz,25%,500mA
22	STEWARD	HI0805R800R-00	FB6, FB7, FB9, FB10, FB13, FB14, FB15, FB16, FB17, FB18, FB19, FB20, FB21	FERRITE,SMT,0805,80 Ω at 100MHz
23	STEWARD	LI1206H151R-00	FB5	FERRITE,SMT,1206,150 Ω at 100MHz,0.8A
24	MOLEX	39357-0003	P2	HEADER, THRU, POWER, 3P,3.5MM, EUROSTYLE
25	SAMTEC	QTH-040-01-L-D-DP-A	P26	HEADER,SMT,80P,0.5mm,FEM,DIFF PAIR,RECEPTACLE,168H
26	SAMTEC	SSQ-104-02-F-D	P9	HEADER,THU,8P,2x4,100LS,FEM,VERT,194TL
27	SAMTEC	TSW-103-08-G-D	P6, P10	HEADER,THU,6P,2x3,MALE,DUAL ROW,100LS,200TL
28	SAMTEC	TSW-107-07-G-D	P7	HEADER,THU,14P,2x7,MALE,DUAL ROW,100LS,100TL
29	SAMTEC	TSW-108-07-G-D	P16	HEADER,THU,16P,2x8,MALE,DUAL ROW,100LS,100TL(UNINSTALLED)
30	TYCO ELECTRONICS	103321-2	P3, P8, P12, P21, P23	HEADER W/SHUNT,2P,100LS

Table 3. Bill of Materials (continued)

Item	MFG	MFG Part Number	RefDes	Value or Function
31	MOLEX	22-23-2021-P	P4, P24	MALE,2PIN,.100CC W/ FRICTION LOCK
32	MILL-MAX	350-10-103-00-006	P13, P18, P22	HEADER,THU,MAL,0.1LS,3P,1x3,284H,110TL
33	MOLEX	22-23-2041	P1	4P, VERT, FRICTION LOCK
34	TYCO ELECTRONICS	4-103239-0x3	P5, P11, P14, P15, P19, P20	HEADER,THU,MAL,0.1LS,3P,1x3
35	TI	AFE5804	DUT1	AFE5804 8-CH ULTRASOUND ANALOG FRONT END
36	MAXIM	MAX3221CAE	U2	RS-232 TRANSCEIVERS
37	MOTOROLA	MMBD7000LT1	D1, D2	DUAL SWITCHING DIODE
38	PHILIPS	BAP50-04	D3	PIN DIODE SOT 23 SINGLE JUNCTION
39	TI	TPS79633DCQR	U7(UNINSTALLED), U8	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR,3.3V
40	TI/BURR-BROWN	OPA820IDBV	U1	UNITY-GAIN STABLE LOW NOISE VOLTAGE FEEDBACK OPAMP
41	TI	TPS79318DBV	U6	1.8V,ULTRALOW-NOISE HI PSRR FAST RF 200mA LDO LINEAR REGULATOR
42	TI	TPS79325DBV	U9	2.5V,ULTRALOW-NOISE HI PSRR FAST RF 200mA LDO LINEAR REGULATOR
43	FUTURE TECHNOLOGY DEVICE INT.	FT245RL	U10	USB FIFO IC INCORPORATE FTDICHIP-ID SECURITY DONGLE
44	PANASONIC	ELJFA221J	L1	220µH, 5%
45	TAIYO-YUDEN	LK 1608 330M	FB1, FB11, FB12	INDUCTOR,SMT0603,33.0µH,20%
46	PANASONIC	LNJ308G8PRA	LED1, LED2, LED3, LED5	LED,SMT,0603,PURE GREEN,2.03V
47	PANASONIC	LNJ808R8ERA	LED4	LED,SMT,0603,ORANGE,1.8V
48	ECS	ECS-3953M-400-BN	U5	OSC,SMT,3.3V,50ppm,–40~85C,5nS,40.000 MHz
49	PANASONIC	ERJ-2GE0R00X	R26, R27, R40, R42, R44, R48, R53, R55, R56, R63, R65	RESISTOR/JUMPER,SMT,0402,0 Ω,5%,1/16W
50	PANASONIC	ERJ-2GEJ0000(UN)	R6, R7, R29, R30, R31, R32, R34, R35, R36, R37, R39, R43, R46, R49, R54, R59, R60, R62, R64	UNINSTALLED PART
51	PANASONIC	ERJ-2GEJ131	R66, R69	RESISTOR, SMT, 0402, 130 Ω, ±1%, 1/16W
52	PANASONIC	ERJ-2GEJ49R9(UN)	R4, R9, R22	UNINSTALLED PART
53	PANASONIC	ERJ-2RKF5602X	R57	RESISTOR, SMT, 0402, 56K Ω, 1%, 1/16W
54	PANASONIC	ERJ-2GEJ820	R67, R68	RESISTOR, SMT, 0402, ±5%,82
55	PANASONIC	ERJ-2RKF1000X	R24, R25	RESISTOR,SMT,0402,100 Ω,1%,1/16W
56	PANASONIC	ERJ-2RKF1001X	R13, R14, R18, R47	RESISTOR,SMT,0402,1.00K,1%,1/16W
57	PANASONIC	ERJ-2RKF1002X	R33, R58	RESISTOR,SMT,0402,10.0K,1%,1/16W
58	PANASONIC	ERJ-2RKF2000X	R52	RES,SMT,0402,200 Ω,1%,1/16W
59	PANASONIC	ERJ-2RKF3320X	R16, R20, R38, R45	RES,SMT,0402,332 Ω,1%,1/16W
60	PANASONIC	ERJ-2RKF4020X	R8	RES,SMT,0402,402 Ω,1%,1/16W
61	PANASONIC	ERJ-2RKF4992X	R28	RESISTOR,SMT,0402,49.9K,1%,1/16W
62	PANASONIC	ERJ-2RKF49R9X	R1, R2, R3, R5, R10, R11, R15, R17, R21, R23, R61	RESISTOR,SMT,0402,49.9 Ω,1%,1/16W
63	PANASONIC	ERJ-2RKF7500X	R50, R51	RES,SMT,0402,750 Ω,1%,1/16W
64	VISHAY	CRCW06031742F	R19	RES,SMT,0603,17.4K Ω, 1%
65	PANASONIC	ERJ-6RQF5R1V	R41	SMT,RES,0805,1/8W, 1%, 5.1 Ω
66	PANASONIC	ERJ-1GE0R00C	EP3, EP5	RESISTOR,SMT,0201,THICK FILM,0 Ω,5%,0 Ω JUMPER,1/20W
67	C&K	TD06H0SK1	SW1, SW2	DIP SWITCH,SMT,6POS,SPST,MINIATURE
68	PANASONIC	EVQPE104K	S1	SQUARE LIGHT TOUCH SWITCH,SMT,SPST
69	KEYSTONE ELECTRONICS	5005	TP8	TESTPOINT,THU,COMPACT,0.125LS,130TL, RED
70	KEYSTONE ELECTRONICS	5006	TP1, TP2, TP5, TP6, TP10	TESTPOINT,THU,COMPACT,0.125LS,130TL, BLACK
71	KEYSTONE ELECTRONICS	5006(UN)	TP3, TP4, TP7, TP9	UNINSTALLED PART (TEST POINT)

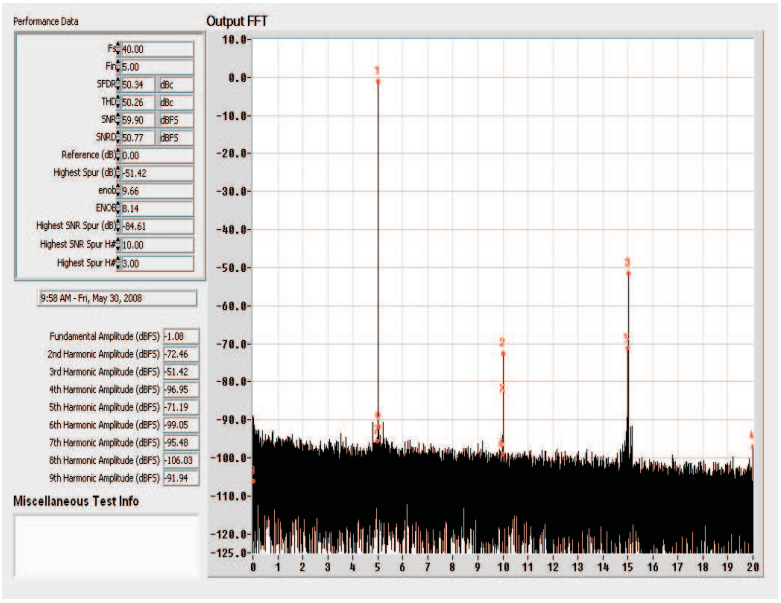
Table 3. Bill of Materials (continued)

Item	MFG	MFG Part Number	RefDes	Value or Function
72	KEYSTONE ELECTRONICS	5007	TP11	TESTPOINT,THU,COMPACT,0.125LS,130TL, WHITE
73	MINI-CIRCUITS	ADTI-6T	T1(UNINSTALLED), T2	RF TRANSFORMER WIDEBAND, 0.03-125 MHz
74	BOURNS	3296W-1-103	R12	TRIMPOT,THU,10K,10%,0.5W,100ppm,25T
75	AMP	531220-2	P3, P8, P12, P21, P23	SHUNTS
76	KEYSTONE ELECTRONICS	1892	H1,H2,H3,H4; (H3 and H4 are UNINSTALLED)	STANDOFF HEX 4-40 THR 0.375"L ALUM
77	BUILDING FASTENERS	PMS 440 0025 SL	H1,H2,H3,H4; (H3 and H4 are UNINSTALLED)	SCREW MACHINE SLOTTED 4-40x1/4

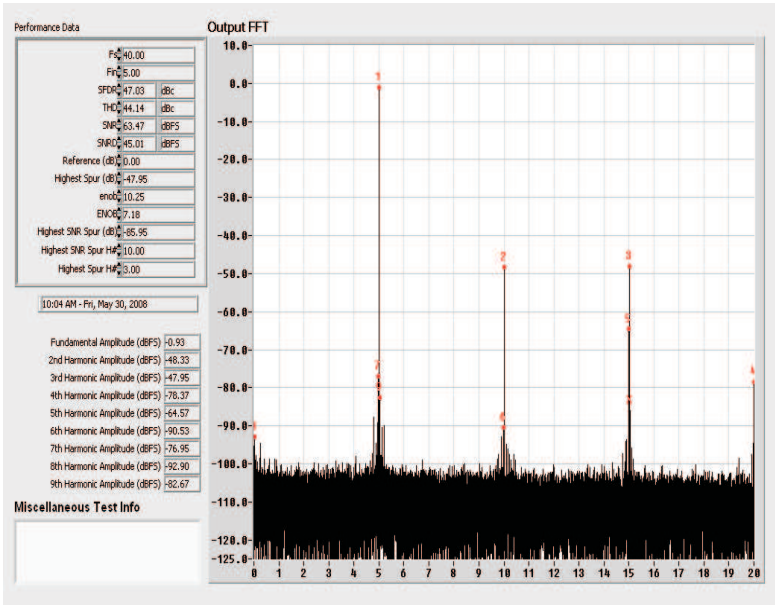
5 Typical Performance

This section provides some typical performance characteristics of the AFE5804EVM to assist users in verifying their setup.

After analysis of the data file acquired by a logic analyzer, the SNR of the AFE5804 should be better than 59 dB when the PGA is set to 30 dB, the filter is set to 12.5 MHz, the mode is set to TGC1, and Vctnl is set as 1 V. A typical performance plot of the AFE5804 is shown in Figure 18.



(a) PGA = 30 dB, Vcntl = 1 V, Vin = 11 mVpp



(b) PGA = 30 dB, Vcntl = 0.34 V, Vin = 290 mVpp

Figure 18. Typical Performances of AFE5804

As Figure 18 shows, the SNR degrades as the gain increases; the HD degrades as the input signal increases.

Appendix A TSW1100 for Evaluating AFE5804/5

This appendix describes the use of TSW1100 software to analyze data files acquired by logic analyzers.

As previously mentioned, coherent sampling is recommended when HP8644s are used. The calculation of coherent sampling rate and signal frequency can be found in the TSW1100 user's manual (SLAU163).

Users can set the calculated frequencies for signal generators; acquire ADC data through a logic analyzer; and save the data as a text file. A typical data file captured by a logic analyzer must be modified to the following format (i.e., containing only one column):

1981
1615
1292
1046
895
852
927
1113
1394
1737
2110
2477
2798
3044
3196
3237
3162
2978
.
.
.
.

The AFE5804/5 performance analysis can be done as follows:

- First, add some header information to the modified logic analyzer data file as follows. Example files are included in the TSW1100 software package. Modify time, sampling rate, and frequency-in based on your setup:

  TSW1000

  2/12/2007 12:38
  Bits =12
  Sampling Rate =40000000.000
  Frequency in =1998291.0156
  2s complement =No
  Data Format =Decimal

  Raw Captured Data:
  1981
  1615
  1292
  1046
  895
  852
  927
  1113
  1394
  1737
  2110
  2477
  2798

3044
3196
3237
3162
2978
2702
2358

- Then, select TSW1000 as the TI chip as shown in Figure A-1.

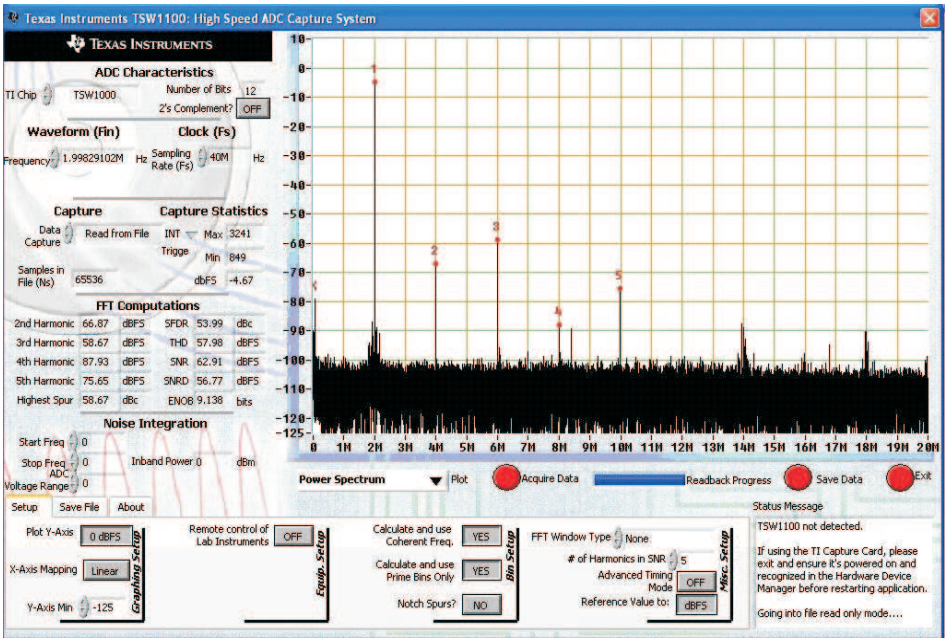
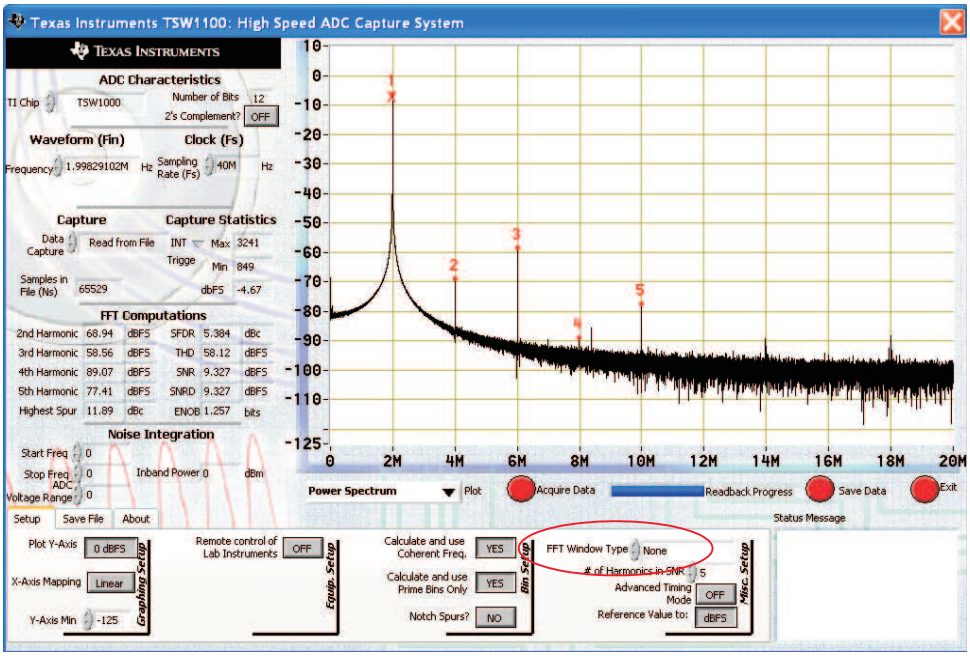


Figure A-1. TSW1100 Interface

- Finally, click the *Acquire Data* button, select the text file with header information, and see the analysis results.

TSW1100 also supports analysis of noncoherent sampled data. However, some artifacts may be noticed during analysis. The appropriate FFT window must be applied to the data.

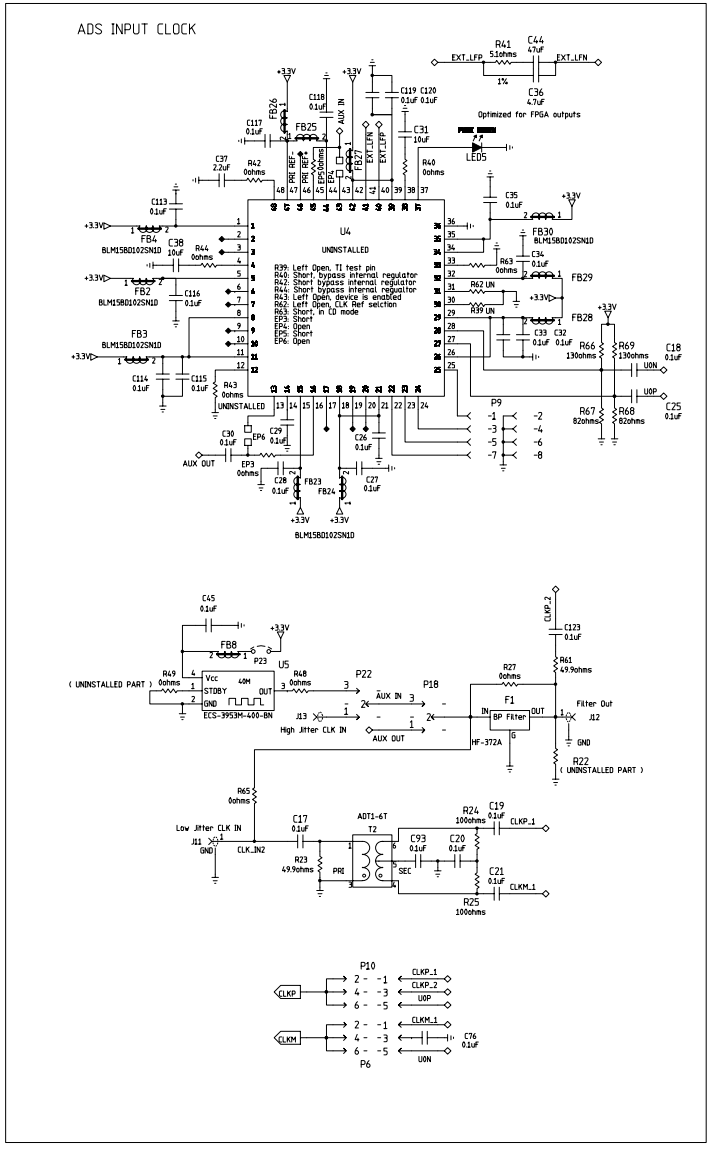
Users must first follow the preceding steps to get the nonwindowed analysis results shown in Figure A-2(a). Then, after the appropriate FFT window is applied, the correct analysis results are obtained as shown in Figure A-2(b). Note that some DC artifacts can be seen in Figure A-1(b).

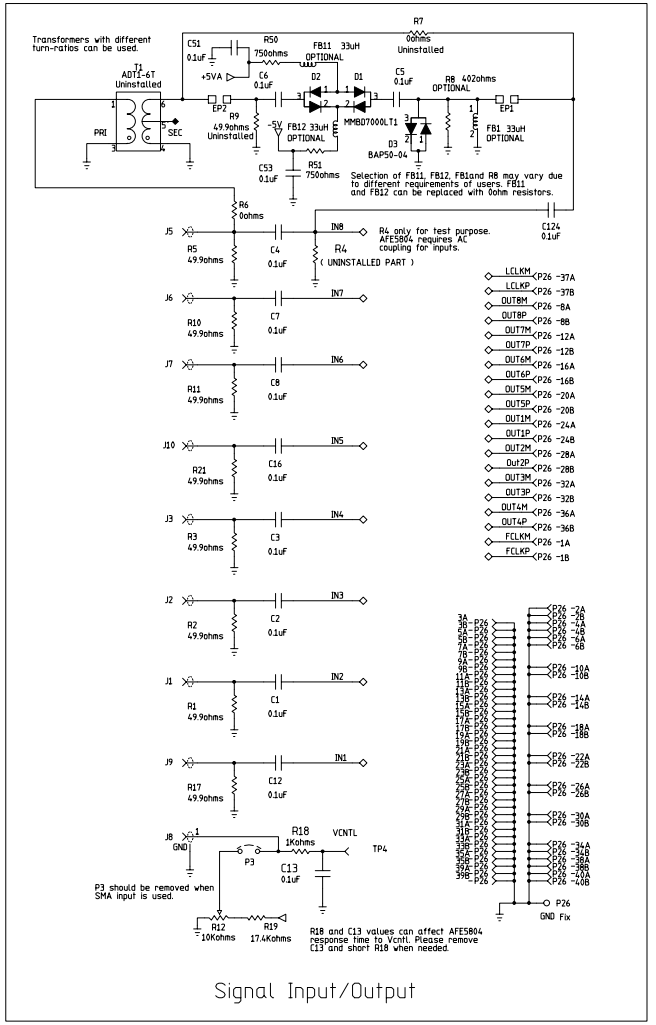


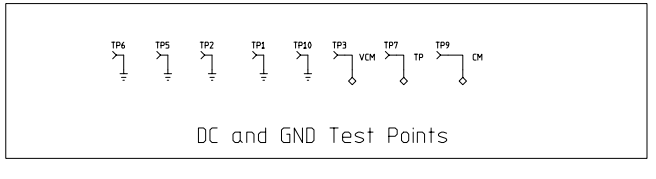
(a) No window applied

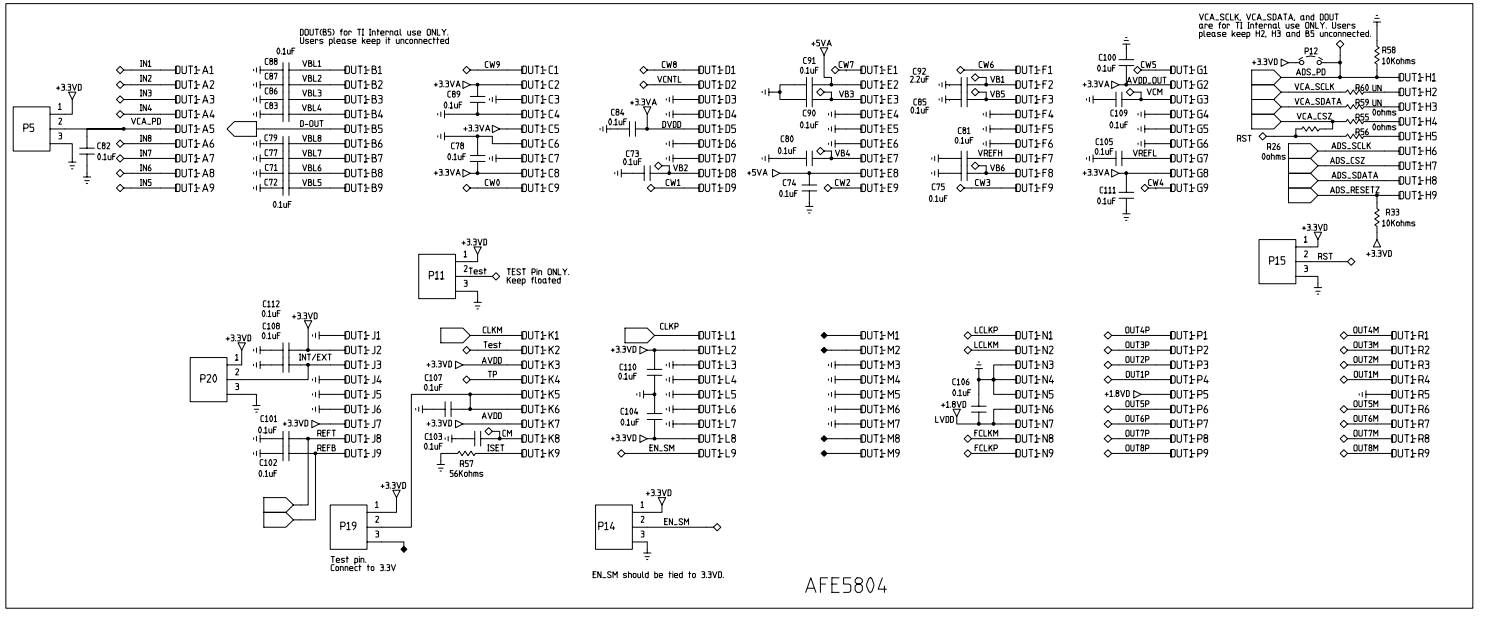
(b) Hanning window applied. Note the DC artifact that is visible.

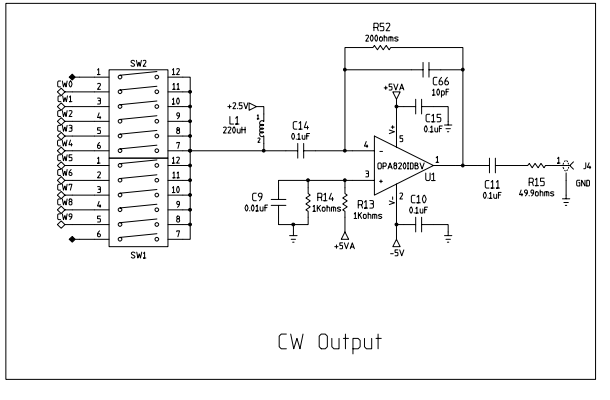
Figure A-2. Analysis of Noncoherent Sampled Data

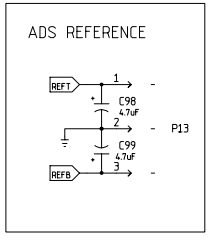

ADS INPUT CLOCK
EXT_LFP
EXT_LFN
R41 5.1ohms 1%
C44 4.7uF
C36 4.7uF
Optimized for FPGA outputs
PURE GREEN
LED5
+3.3V
AUX IN
C119 C120 0.1uF 0.1uF
C118 0.1uF
C117 0.1uF
FB26
FB25
FB27
C31 10uF
C37 2.2uF
R42 0ohms
R40 0ohms
PRI REF-
PRI REF+
EP4
EP5
EP6
EXT_LFP
EXT_LFN
C35 0.1uF
FB30 BLM15BD102SN1D
C34 0.1uF
R63 0ohms
FB29
R62 UN
R39 UN
FB28
R66 130ohms
R69 130ohms
C18 0.1uF
UON
R67 82ohms
R68 82ohms
C25 0.1uF
U0P
C113 0.1uF
FB4 BLM15BD102SN1D
C38 10uF
R44 0ohms
FB2 BLM15BD102SN1D
C116 0.1uF
FB3 BLM15BD102SN1D
C114 0.1uF
C115 0.1uF
R43 0ohms
U4
UNINSTALLED
R39: Left Open, TI test pin
R40: Short bypass internal regulator
R42: Short bypass internal regulator
R44: Short bypass internal regulator
R43: Left Open, device is enabled
R62: Left Open, CLK Ref selection
R63: Short, in CD mode
EP3: Short
EP4: Open
EP5: Short
EP6: Open
P9
-1 -2
-3 -4
-5 -6
-7 -8
C30 0.1uF
EP6
C29 0.1uF
AUX OUT
EP3 0ohms
C28 0.1uF
FB23
FB24
C26 0.1uF
C27 0.1uF
BLM15BD102SN1D
POWER MANAGEMENT
FB9
C47 0.1uF
U6
TPS79318DBV
+1.8VD
C48 22uF
C46 0.1uF
C39 22uF
FB13
C55 0.1uF
U7
TPS79430DCQR
UNINSTALLED
+3.3VD
C54 22uF
C56 0.1uF
C57 22uF
FB7
+5VD
C43 22uF
C42 0.1uF
FB14
FB19
C63 0.1uF
U8
TPS79633DCQR
+3.3VA
C62 22uF
C64 0.1uF
C65 22uF
FB17
C58 0.1uF
U9
TPS79325DBV
+2.5V
C59 22uF
C67 0.1uF
C68 22uF
FB18
+5VA
C50 22uF
C60 0.1uF
TP8
+5V
P2
-5V
TP11
FB10
-5V
C61 22uF
C52 0.1uF
R16 332ohms
LED1
PURE GREEN
R20 332ohms
LED2
R45 332ohms
LED4
ORANGE
+1.8VD
P4
1 A +2.5V IN
2
FB21
P24
1 D +1.8V IN
2
FB6
P1
1 A +3.3V IN
2
FB20
3
4 D +3.3V IN
FB16
USB SPI CONTROLER
U10
ADS_SCLK
ADS_PD
ADS_CSZ
3.3V_USB
ADS_SDATA
VCA_SCLK
VCA_CSZ
VCA_SDATA
ADS_RESETZ
FT245RL
C40 0.1uF
C122 0.1uF
C41 0.1uF
+5VD
R47 1Kohms
P23
Do Not Intall
R46 1Kohms
3.3V_USB
+5VD
R64 0ohms
(UNINSTALLED PART)
USB_VCC
C121 0.1uF
C49* 22uF
FB31 BLM18EG601SN1D
USB_D-
USB_D+
P25
PAD
MNE20-5KSP10
UNINSTALLED
P16-1
P16-3
P16-5
P16-7
P16-9
P16-11
P16-13
P16-15
RS232 SPI CONTROLER
P7
FB22
+3.3VD
C96 0.1uF
C97 10pF
Y1 4.194304
C95 10pF
/RESET_MSP
C94 0.1uF
R28 49.9kohms
S1
VCA_CSZ
VCA_SDATA
D-OUT
VCA_SCLK
R34 0ohms
R35 0ohms
R36 0ohms
R37 0ohms
R34-37 uninstalled when USB SPI is used
MSP430F1232IPW
R29-32 uninstalled when USB SPI is used
R29 0ohms
R30 0ohms
R31 0ohms
R32 0ohms
ADS_RESETZ
ADS_SDATA
ADS_SCLK
ADS_CSZ
R38 332ohms
PURE GREEN
LED3
+3.3VD
U3
P8
C23 0.1uF
C69 0.1uF
C22 0.1uF
C70 0.1uF
C24 0.1uF
P17
R53 0ohms
R54 0ohms
UN
MAX3221CAE
U2
HARDWARE
STAND-OFFS
H1
H2
H3
H4
P10
CLKP
CLKM
CLKP_1
CLKP_2
U0P
CLKM_1
U0N
C76 0.1uF
P6
CLKP_2
C123 0.1uF
R61 49.9ohms
P22
AUX IN
P18
R27 0ohms
F1
BP Filter
Filter Out
J12
J13
High Jitter CLK IN
AUX OUT
HF-372A
R22 (UNINSTALLED PART)
R65 0ohms
Low Jitter CLK IN
J11
CLK_IN2
C17 0.1uF
ADT1-6T
T2
R23 49.9ohms
PRI
SEC
C93 0.1uF
C20 0.1uF
R24 100ohms
C19 0.1uF
CLKP_1
C21 0.1uF
CLKM_1
R25 100ohms
R45 0ohms
(UNINSTALLED PART)
C45 0.1uF
FB8
P23
U5
R49 0ohms
R48 0ohms
STDBY
Vcc
GND
OUT
40M
ECS-3953M-400-BN


Transformers with different turn-ratios can be used.
T1 ADT1-6T Uninstalled
PRI
SEC
C51 0.1uF
+5VA
R50 750ohms
FB11 33uH OPTIONAL
R7 0ohms Uninstalled
C6 0.1uF
D2
D1
MMBD7000LT1
C5 0.1uF
R8 402ohms OPTIONAL
EP2
EP1
R9 49.9ohms Uninstalled
-5V
FB12 33uH OPTIONAL
D3 BAP50-04
FB1 33uH OPTIONAL
C53 0.1uF
R51 750ohms
Selection of FB11, FB12, FB1and R8 may vary due to different requirements of users. FB11 and FB12 can be replaced with 0ohm resistors.
R6 0ohms
C124 0.1uF
J5
IN8
R5 49.9ohms
C4 0.1uF
R4 (UNINSTALLED PART)
R4 only for test purpose. AFE5804 requires AC coupling for inputs.
J6
IN7
R10 49.9ohms
C7 0.1uF
J7
IN6
R11 49.9ohms
C8 0.1uF
J10
IN5
R21 49.9ohms
C16 0.1uF
J3
IN4
R3 49.9ohms
C3 0.1uF
J2
IN3
R2 49.9ohms
C2 0.1uF
J1
IN2
R1 49.9ohms
C1 0.1uF
J9
IN1
R17 49.9ohms
C12 0.1uF
LCLKM P26 -37A
LCLKP P26 -37B
OUT8M P26 -8A
OUT8P P26 -8B
OUT7M P26 -12A
OUT7P P26 -12B
OUT6M P26 -16A
OUT6P P26 -16B
OUT5M P26 -20A
OUT5P P26 -20B
OUT1M P26 -24A
OUT1P P26 -24B
OUT2M P26 -28A
OUT2P P26 -28B
OUT3M P26 -32A
OUT3P P26 -32B
OUT4M P26 -36A
OUT4P P26 -36B
FCLKM P26 -1A
FCLKP P26 -1B
P26 -2A
P26 -2B
P26 -4A
P26 -4B
P26 -6A
P26 -6B
P26 -10A
P26 -10B
P26 -14A
P26 -14B
P26 -18A
P26 -18B
P26 -22A
P26 -22B
P26 -26A
P26 -26B
P26 -30A
P26 -30B
P26 -34A
P26 -34B
P26 -38A
P26 -38B
P26 -40A
P26 -40B
P26
GND Fix
J8
GND
R18 1Kohms
VCNTL
TP4
P3
C13 0.1uF
P3 should be removed when SMA input is used.
R12 10Kohms
R19 17.4Kohms
R18 and C13 values can affect AFE5804 response time to Vcntl. Please remove C13 and short R18 when needed.
Signal Input/Output


TP6
TP5
TP2
TP1
TP10
TP3
VCM
TP7
TP
TP9
CM
DC and GND Test Points


DOUT(B5) for TI Internal use ONLY. Users please keep it unconnected
VCA_SCLK, VCA_SDATA, and DOUT are for TI Internal use ONLY. Users please keep HZ, H3 and B5 unconnected.
P5
VCA_PD
P11
Test
TEST Pin ONLY. Keep floated
P20
INT/EXT
P19
Test pin. Connect to 3.3V
P14
EN_SM
EN_SM should be tied to 3.3VD.
P12
ADS_PD
VCA_SCLK
VCA_SDATA
VCA_CSZ
ADS_SCLK
ADS_CSZ
ADS_SDATA
ADS_RESET
P15
RST
AFE5804


SW2
SW1
R52 200ohms
C66 10pF
C15 0.1uF
+2.5V
L1 220uH
C14 0.1uF
OPA820IDBV
U1
C9 0.01uF
R14 1Kohms
R13 1Kohms
C10 0.1uF
C11 0.1uF
R15 49.9ohms
J4
GND
CW Output


ADS REFERENCE
REFT
REFB
C98 4.7uF
C99 4.7uF
P13

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Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

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During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 0°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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