AFE5812EVM Evaluation Module

This document assists in evaluating the AFE5812 highly integrated analog front-end devices through the use of the AFE5812EVM Evaluation Module. Included are setup instructions, printed-circuit board art, bill of materials, and schematics.

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1 Overview

This document is intended as a step-by-step guide through the AFE5812EVM setup and test. The EVM is shipped with a default configuration from the manufacturer. With this configuration, the onboard CMOS clock is used for an analog-to-digital converter sampling clock; the onboard oscillator is used for CW mode operation. No external clock generator is required. Users need to provide the analog input signal for measurement from a signal generator or any desired source.

Detailed explanations regarding the jumpers, connectors, and test points appear in Section 6. The graphical user interface (GUI) for the AFE5812EVM can be downloaded from the TI website or from a TI engineer. The GUI for the TSW1400EVM, called High Speed Data Converter Pro, can be downloaded from the TI website. Version 4.0 or higher is required.

Figure 1 shows the default configuration of the EVM from the factory. The accompanying list identifies the basic components on the EVM board.

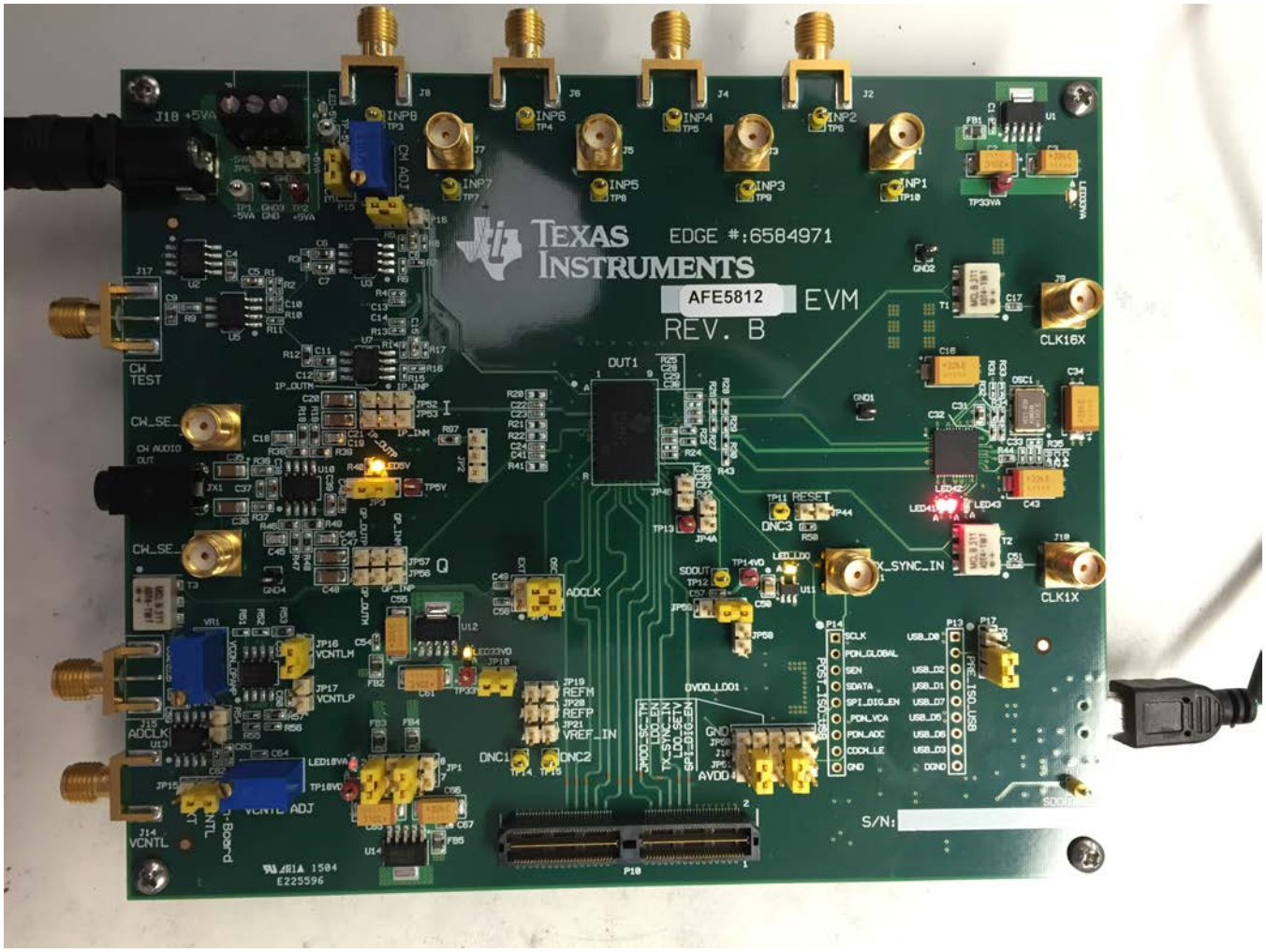


Figure 1. AFE5812EVM Basic Configuration

1. P1 – Power supplies connector ±5 V.
2. JP1, JP2, and JP3 are set to enable 3.3-V, 1.8-V, and 5-V power supplies to the device.
3. JP9: Enables onboard CMOS clock.
4. JP10: Power supply for onboard CMOS clock oscillator.
5. JP15: Enables onboard Vcntl.
6. JP59: Connects 1.4-V supply (LED_LDO should be lit).

7. P17: Disables PDN_Global.
8. P15: Choose the device Common Mode for the I/V Amp Common Mode.
9. P16: Selects Vss as –5 V for low-side power supply on the I/V Amp.
10. JP16 is set to enable the demodulator internal LDO, as shown in Figure 1.

2 Software Installation and Operation

This EVM test requires both the AFE5812EVM GUI for the AFE EVM and also the High Speed Data Converter Pro (HSDCPro) GUI for the TSW1400 EVM. Please consult the HSDCPro manual for information regarding that GUI. The AFE5812EVM GUI can be downloaded from the TI website or by contacting the TI engineer. Run the installer executable file to install this GUI and necessary drivers. Only Microsoft® Windows® 7 is supported at this time.

3 Hardware Setup

Two EVMs are required to evaluate the AFE5812 device: the AFE5812EVM and the TSW1400EVM. Figure 2 shows the exact setup of these two boards and external connectors. Make sure the board is seated correctly since there is a capacitor (C66) that sits very close to the connector. See Figure 3 for proper seating. For the default configuration shown in Figure 1, having an external sampling clock and external Vcntl supply is unnecessary. The onboard CMOS clock and onboard Vcntl are used. If the external Vcntl circuit or CW output amplifier circuits are unused, then the-5V supply is not required.

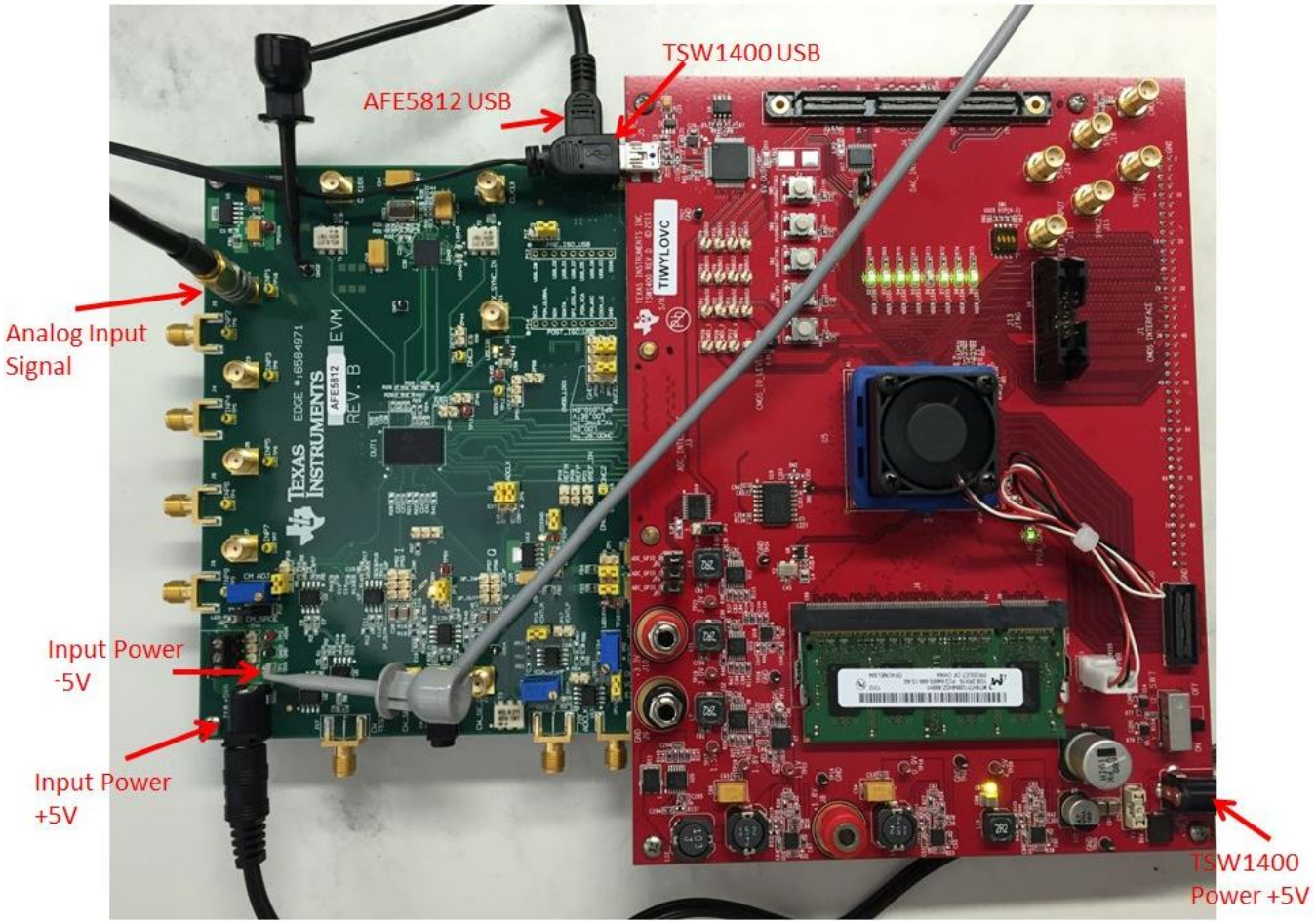


Figure 2. Default HW Setup With Connection between TSW1400EVM and AFE5812EVM

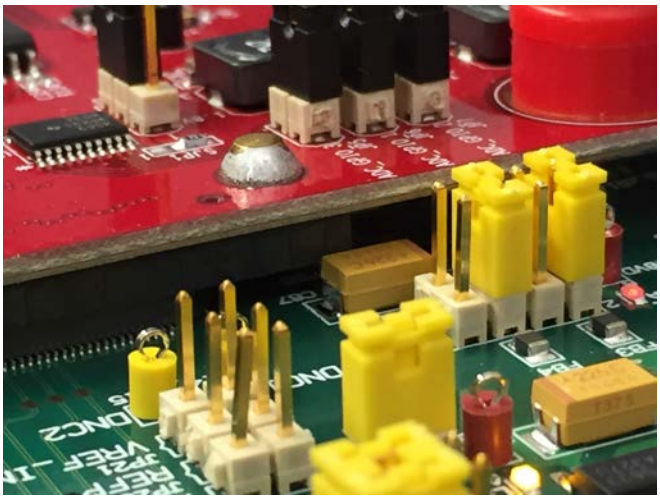


Figure 3. Proper TSW1400 Seating

Power up the AFE5812EVM by applying +5 V (at JP6 or TP2) and –5 V (only needed for CW mode and the Vcntl circuit). After power up is complete, 6 LEDS turn on as shown in Figure 4. If the –5-V supply is plugged in, then another LED-5V will turn on. This is circled in yellow.

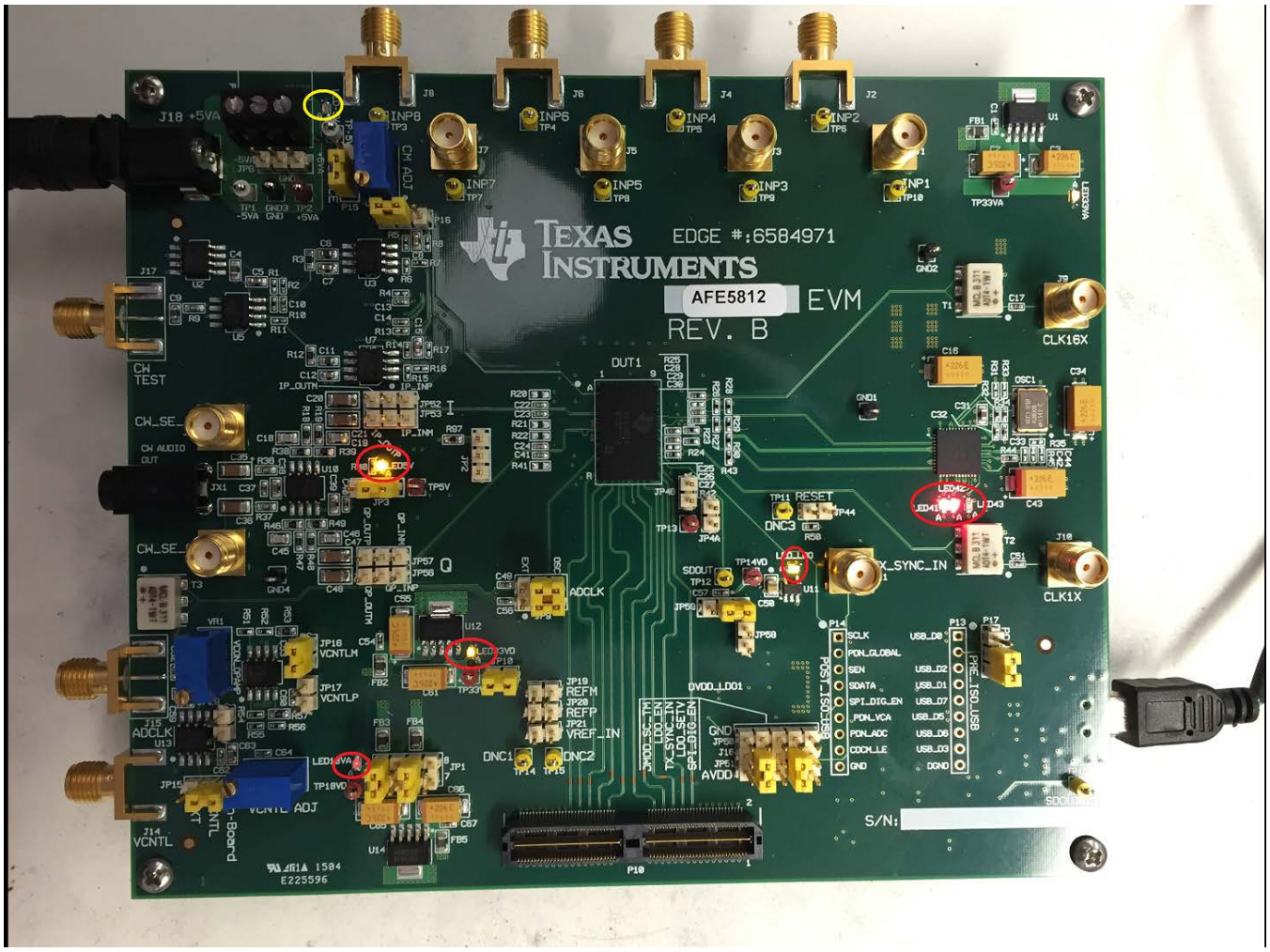


Figure 4. LED Placement

4 Software Setup

4.1 Launch AFE5812 GUI

Launch the AFE5812 graphic user interface (GUI):.

1. Open the AFE5812 GUI software from the windows Start menu.
2. If the USB cable is connected properly, GUI front page will look like Figure 5.

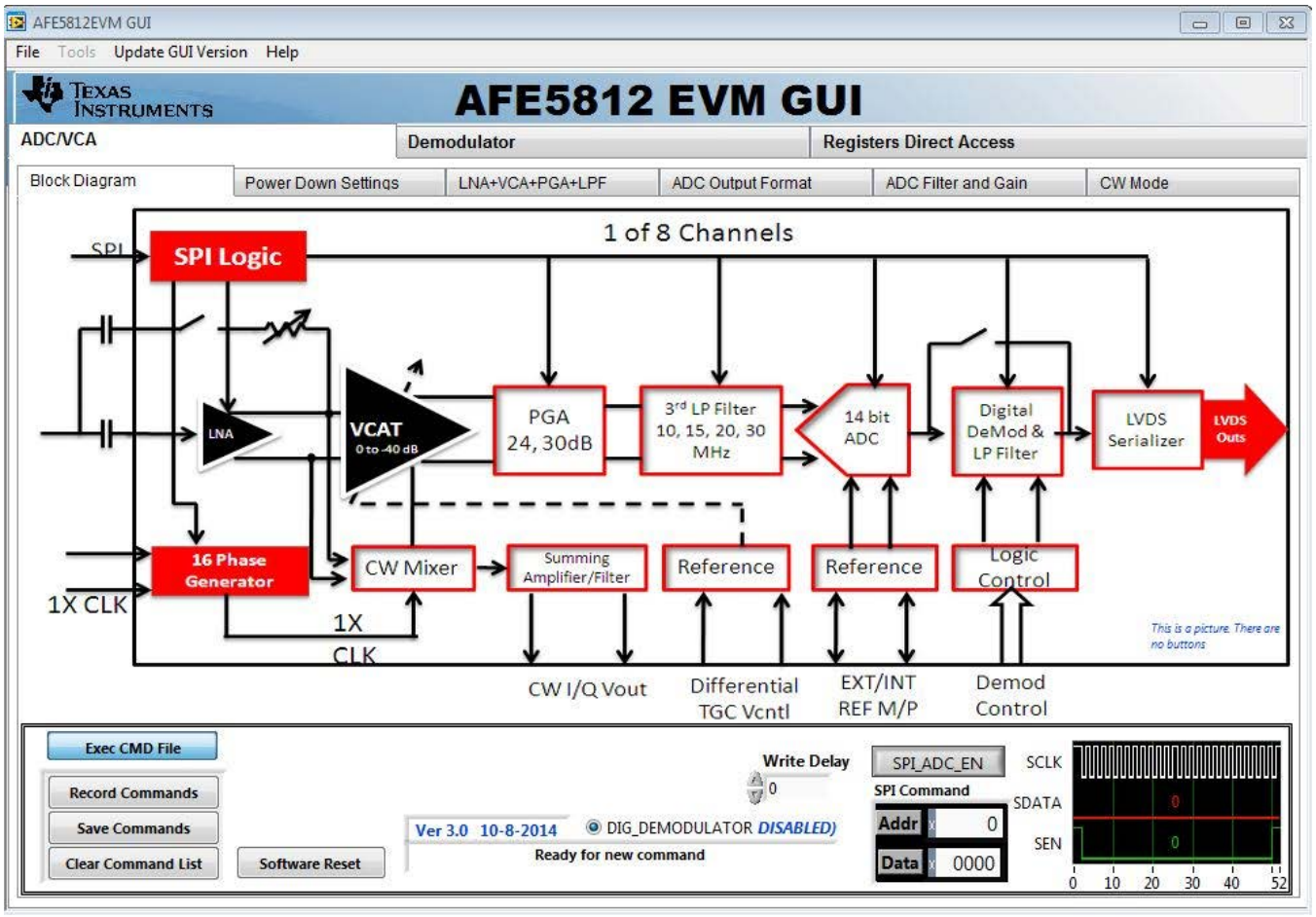


Figure 5. Front Page for AFE5812 GUI, HW connected properly

3. To confirm USB communication, Reset GUI with “Software Reset” button. Expected Current consumption is ~718mA on the +5V supply after reset.
4. Test SPI register write by toggling the PDN_Fast_VCA button and check that the current consumption on the power supply (bench supply) drops when the box is checked. This is done on the ADC/VCA settings page called “Power Down Settings”.

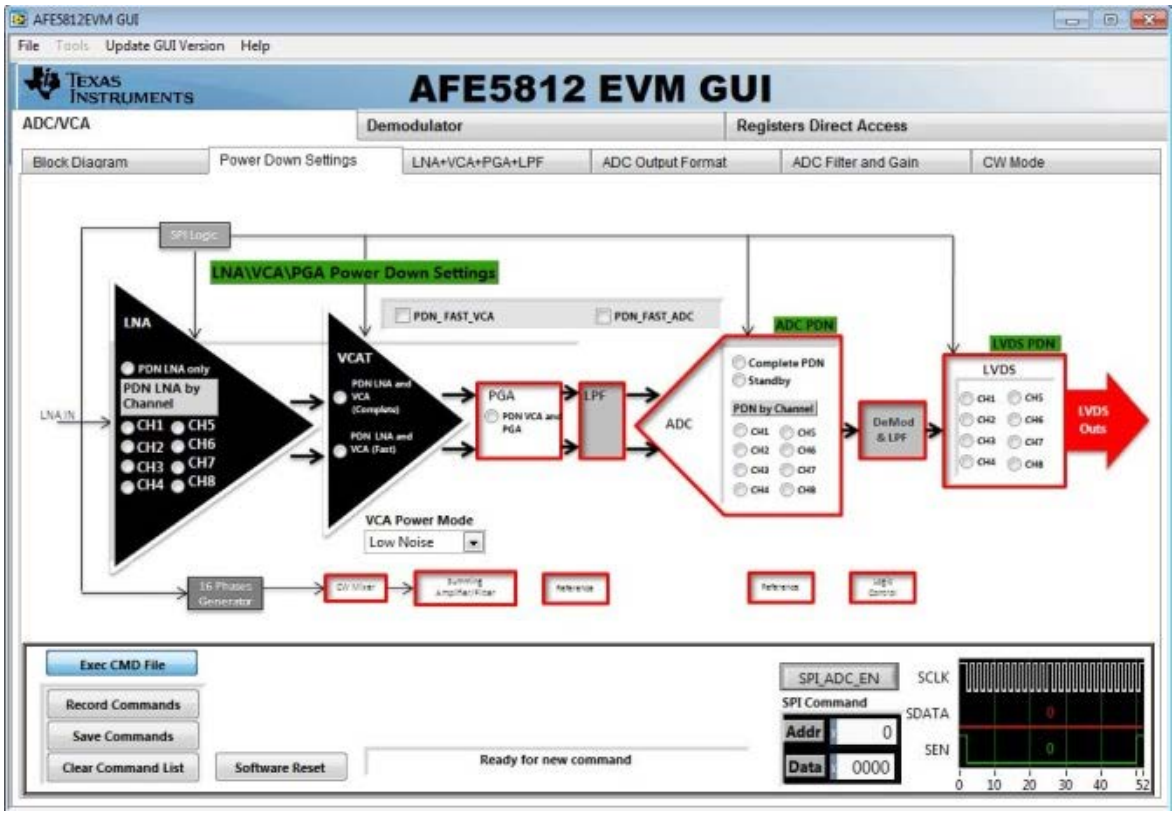


Figure 6. PDN Settings

4.2 Launch TSW1400 GUI (HSDCPro)

1. Launch High Speed Data Converter Pro from the windows Start menu.
2. A Pop-up window should prompt you to connect to the EVM if it is connected via USB. Select the TSW1400 EVM. If a different message or an error message appears, contact the TI FAE. If the GUI connects properly, the status indicator at the bottom says "Connected" in Green.
3. Select AFE5812_14x for the firmware by clicking the green arrow and searching through the drop-down menu.

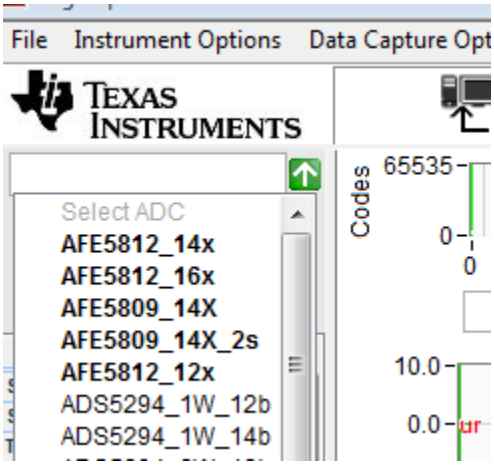


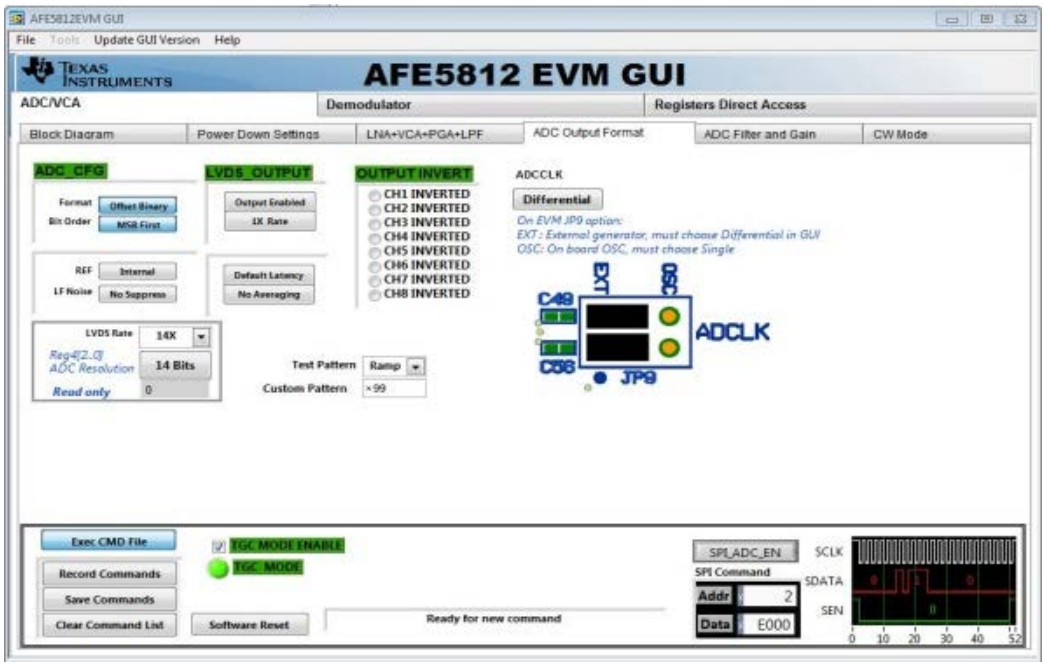
Figure 7. HSDCPro Load

4. Click *Yes* to update firmware on the board. This can take about 30 seconds.After this,LEDs D2-D9 (not D6) on the TSW Board will be lit confirm that the firmware is loaded.
5. *ADC Output Data Rate* in lower left should be set to '40M'; this is the onboard CMOS clock frequency. Set this appropriately if using an external clock.
6. *ADC Input Target Frequency* – enter 5M.

5 Testing

5.1 Capture Ramp Data (Time Domain View)

1. Select the Time Domain page in HSDCPro under the Test Selection drop-down control.
2. In the AFE5812 GUI, Click the *Software Reset* button again.
3. Go to the ADC Output Format page, and then select Ramp.



4. Press the Capture button on the HSDCPro. This displays a ramping waveform on the HSDCPro display area as shown in Figure 8. This is validation that the TSW1400 is receiving data correctly from the AFE EVM.

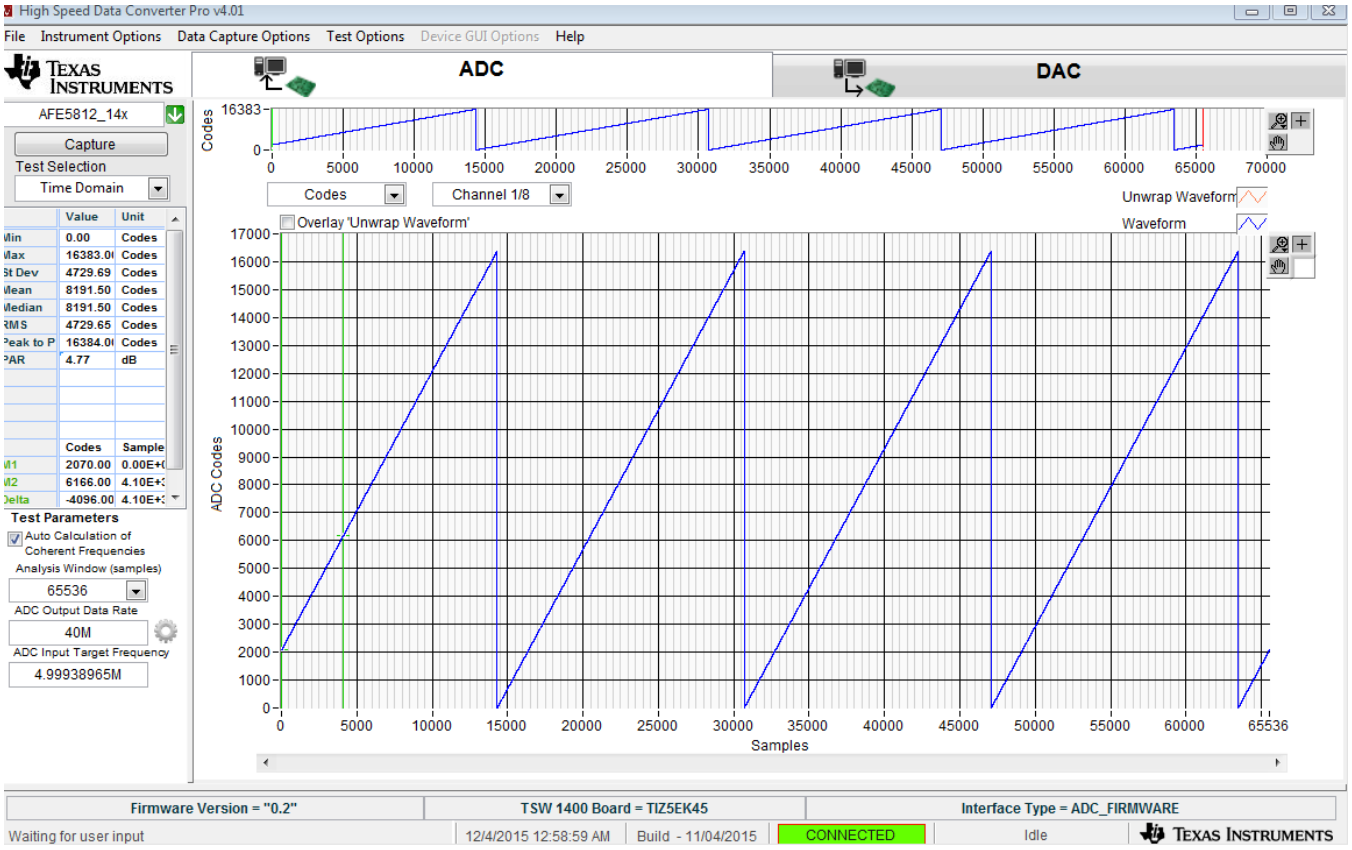


Figure 8. Ramp Waveform Output

5. Verify that Maximum value is 16383 for 14-bit mode.
6. *If each channel has the output as shown in Figure 8, proceed with the next step; otherwise, contact the TI FAE to troubleshoot the problem.*

5.2 Capture Analog Input Data (FFT View)

1. On the AFE5812 GUI, change Test Pattern from *Ramp* to *Analog Input* for the next step. On the same page, change 'Format' from *Offset Binary to 2's Comp.*
2. Next, On the 'LNA+VCA+PGA+LPF' page of the AFE GUI, enable the Active termination resistors and enable the Digital TGC attenuator as in Figure 9. Set the Attenuation to 30dB.

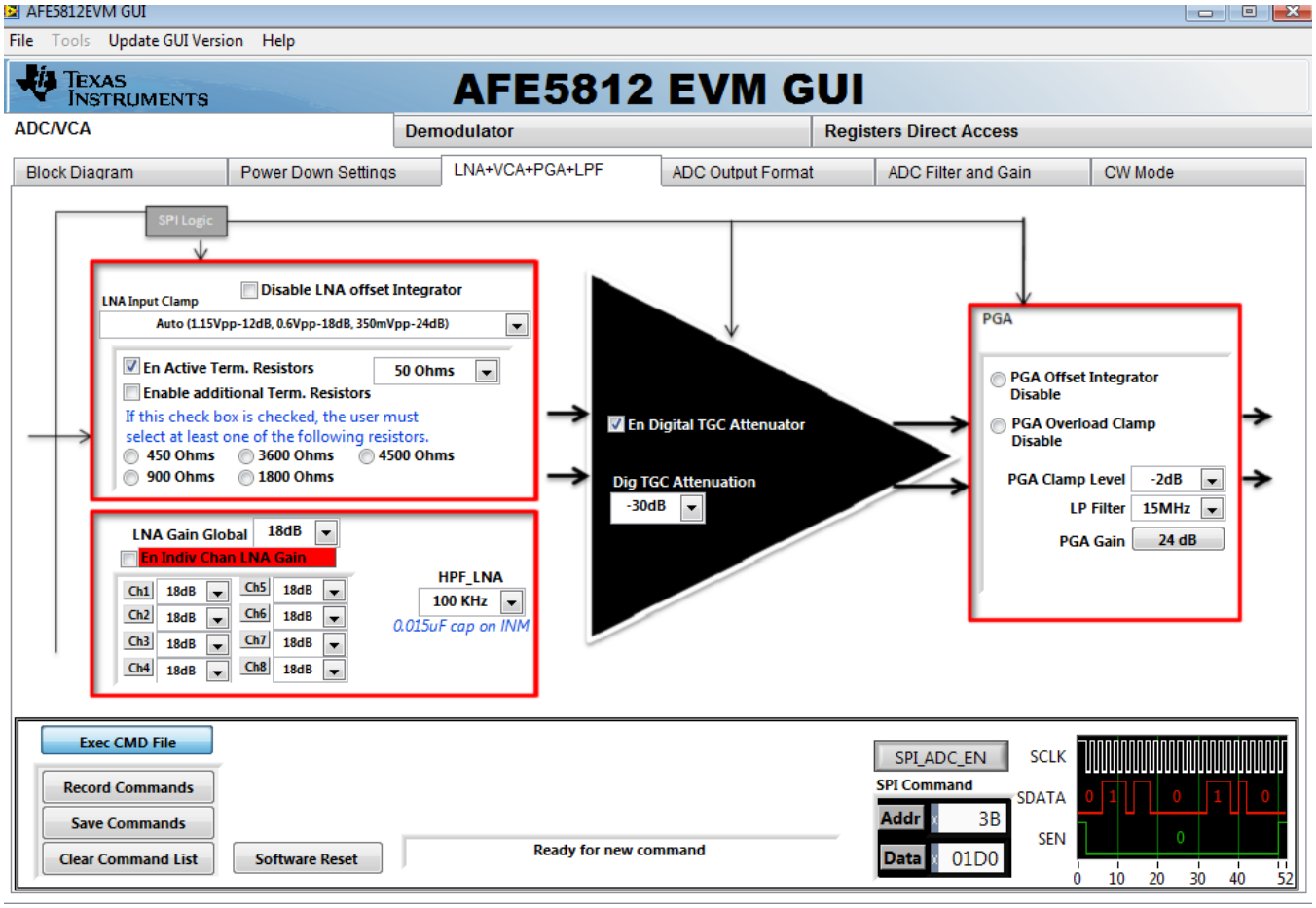


Figure 9. VCA Setup

3. In HSDCPro, Select *Single Tone* from the Test Selection control to display the FFT.
4. Connect the desired test signal. Further example assumes a bench sine wave generator
5. Set the amplitude of the signal generator to *-10 dBm*, and frequency to 5MHz. (A band-pass filter is recommended to achieve the displayed performance).
6. Change the window option to *Hanning* if using the onboard clock. This is because the input signal and the onboard CMOS clock are non-coherent.
7. Press the *Capture* button to get the test result. The resulting waveform should resemble

Figure 10. GUI: Single FFT Format

6 EVM Hardware Reference

6.1 LEDs

The AFE5812EVM has seven LEDs. Their locations are shown in

Table 1. LED Indicators

Reference Designator	Power Supply	Color
LED-5V	–5 V	Orange
LED5V	+5 V	Orange
LED3.3VD	+3.3 VD	Orange

Table 1. LED Indicators (continued)

Reference Designator	Power Supply	Color
LED3.3VA	+3.3 VA	Orange
LED1.8V	+1.8 V	Orange
LED_LDO	+1.4V	Orange
LED41	Clock Buffer Status Indicator	Red
LED42		Red

6.2 Miscellaneous Test Points

Table 2. Test Points

Reference Designator	Description
TP11,TP14.TP15	AFE5812 device test pin DNC1, 2, and 3. Pins L5, M5 and M8
JP19	REFM voltage input
JP44	RESET input. Short to reset AFE5812.
JP20	REFP voltage input
JP21	REF_IN voltage input
TP12	SDOUT
TP3-9	SMA input probes
TP5V, TP18VD, TP33VD, TP33VA, TP-5V, -5VA, +5VA, TP14VD, DVDD_LDO1	Power supply test points

6.3 Schematics

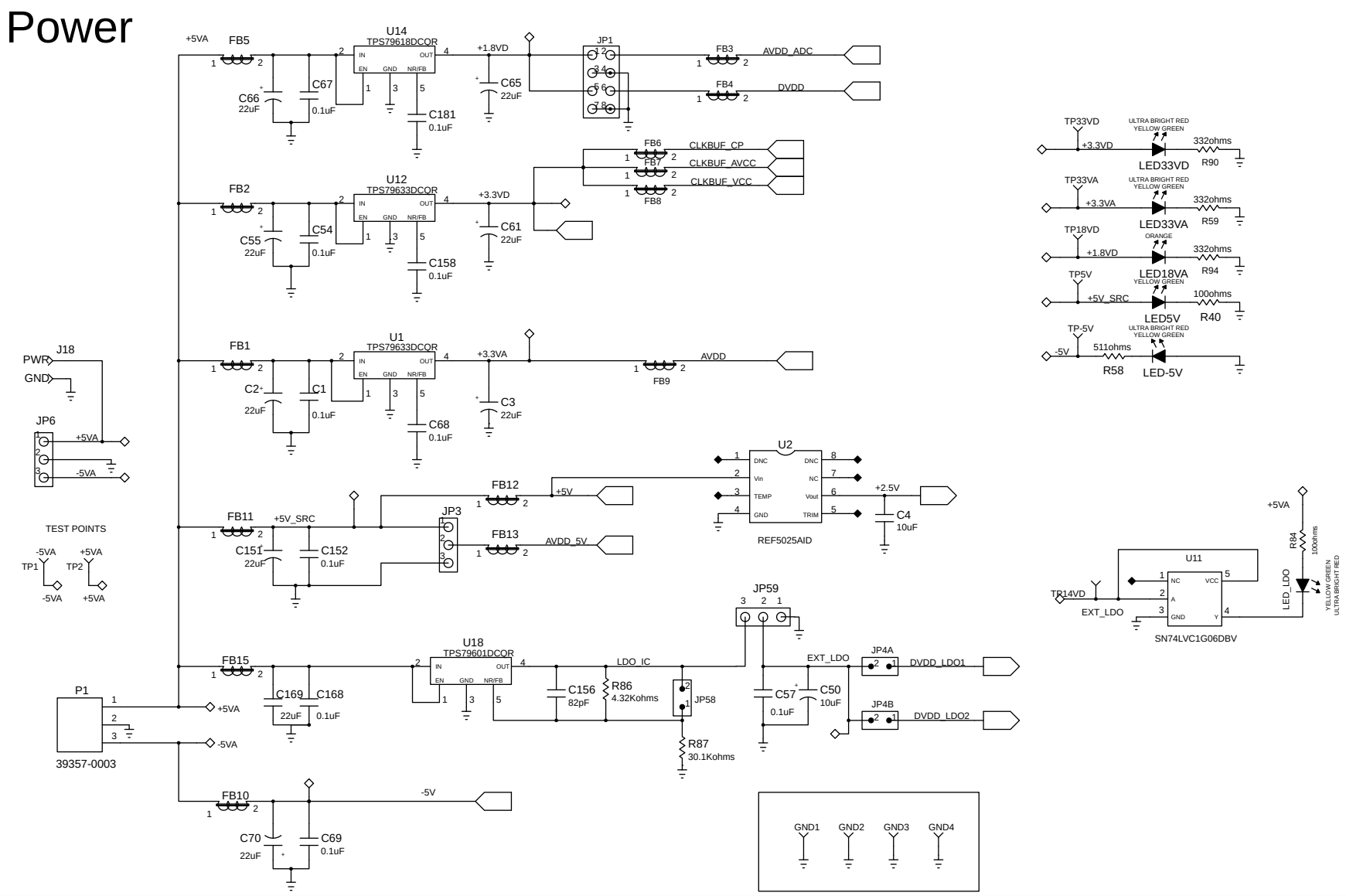


Figure 11. Schematic (Sheet 1 of 10)

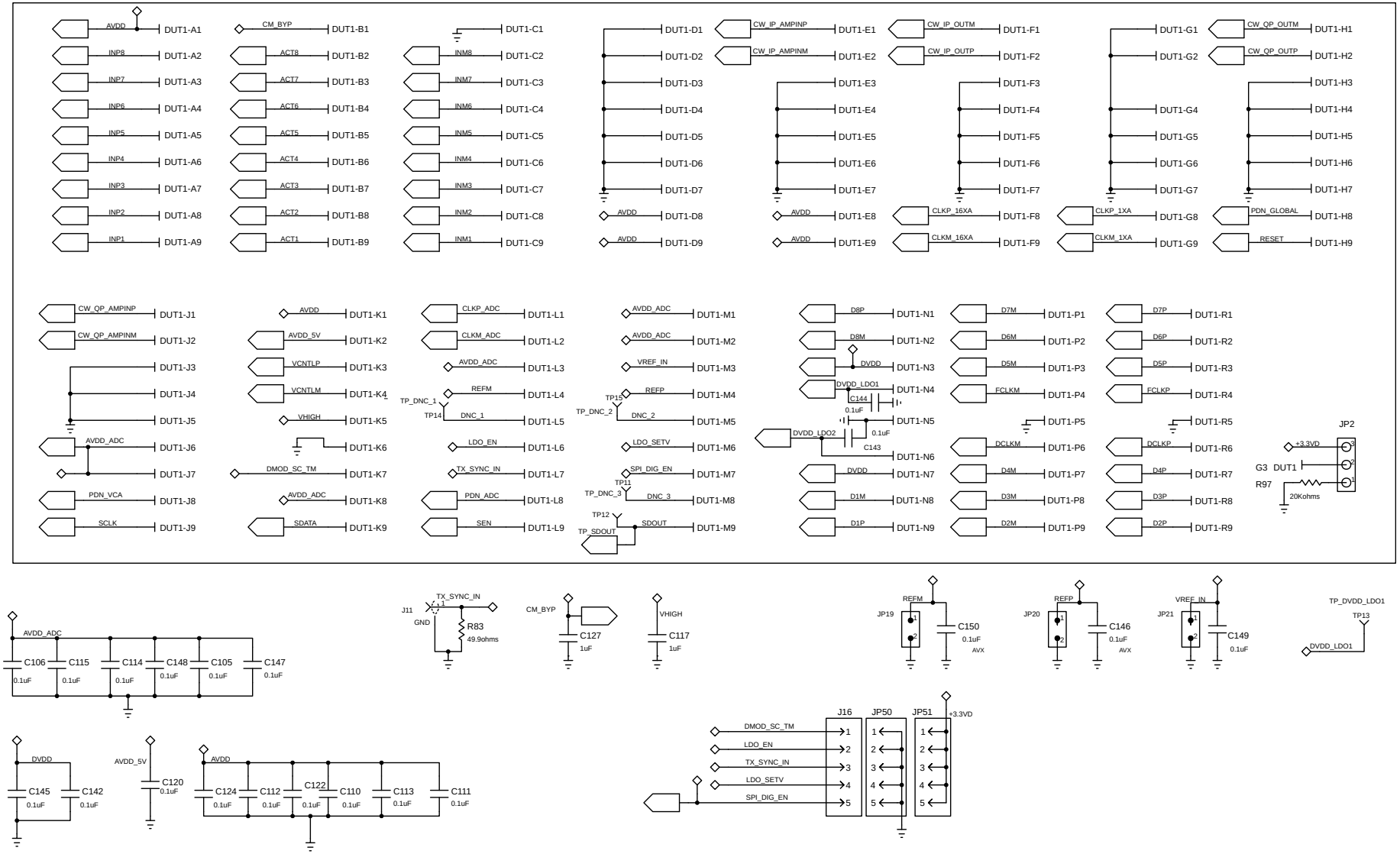
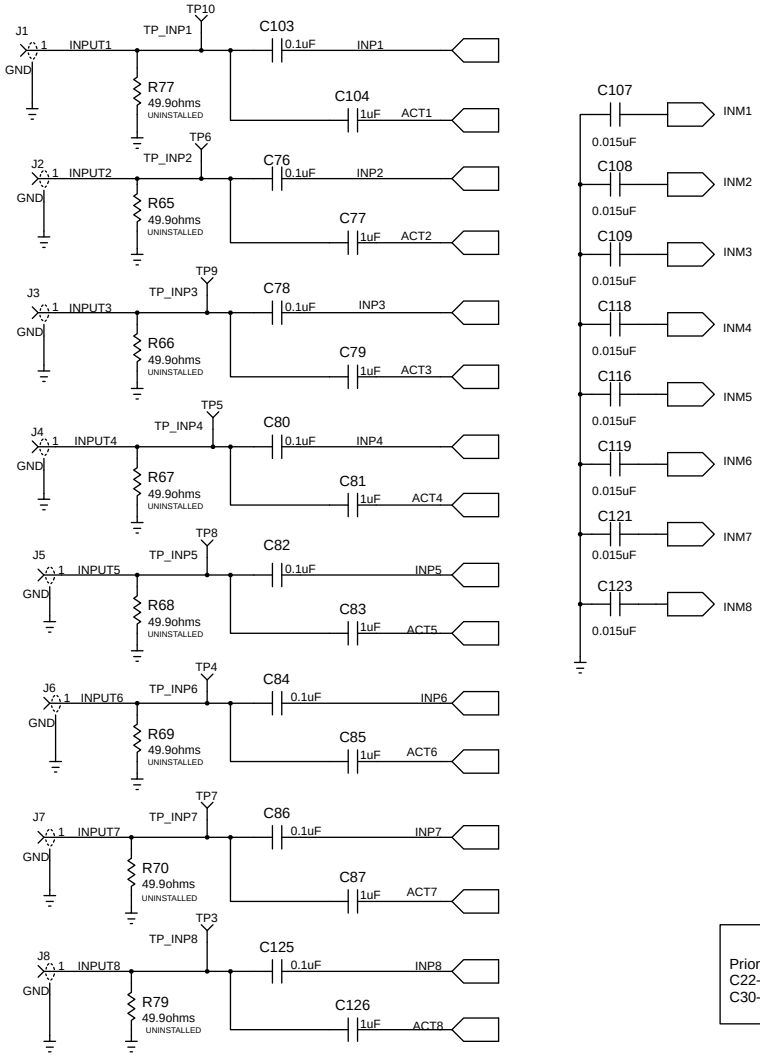


Figure 12. Schematic (Sheet 2 of 10)

VCA INPUT



Priority of Close to Pins INPx
C22-C29 1st
C30-C37 2nd

ADC OUTPUT

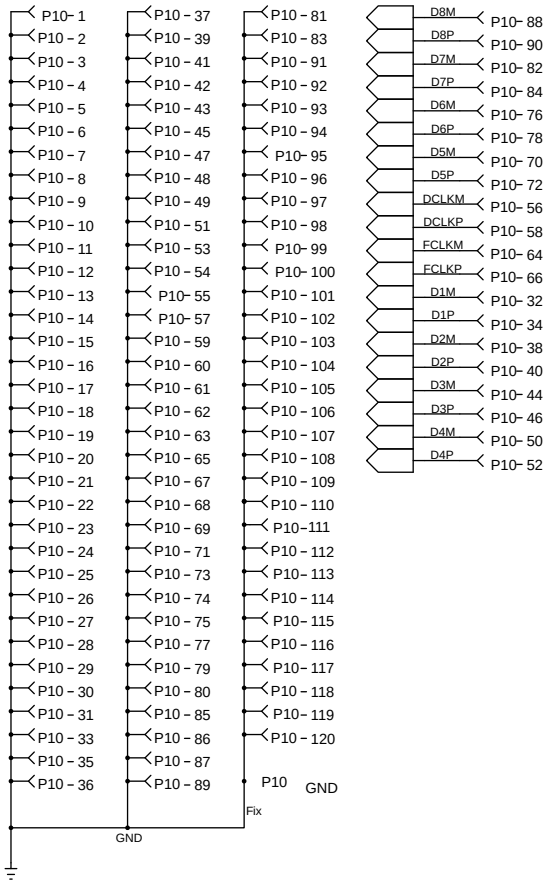


Figure 13. Schematic (Sheet 3 of 10)

Clock Buffer

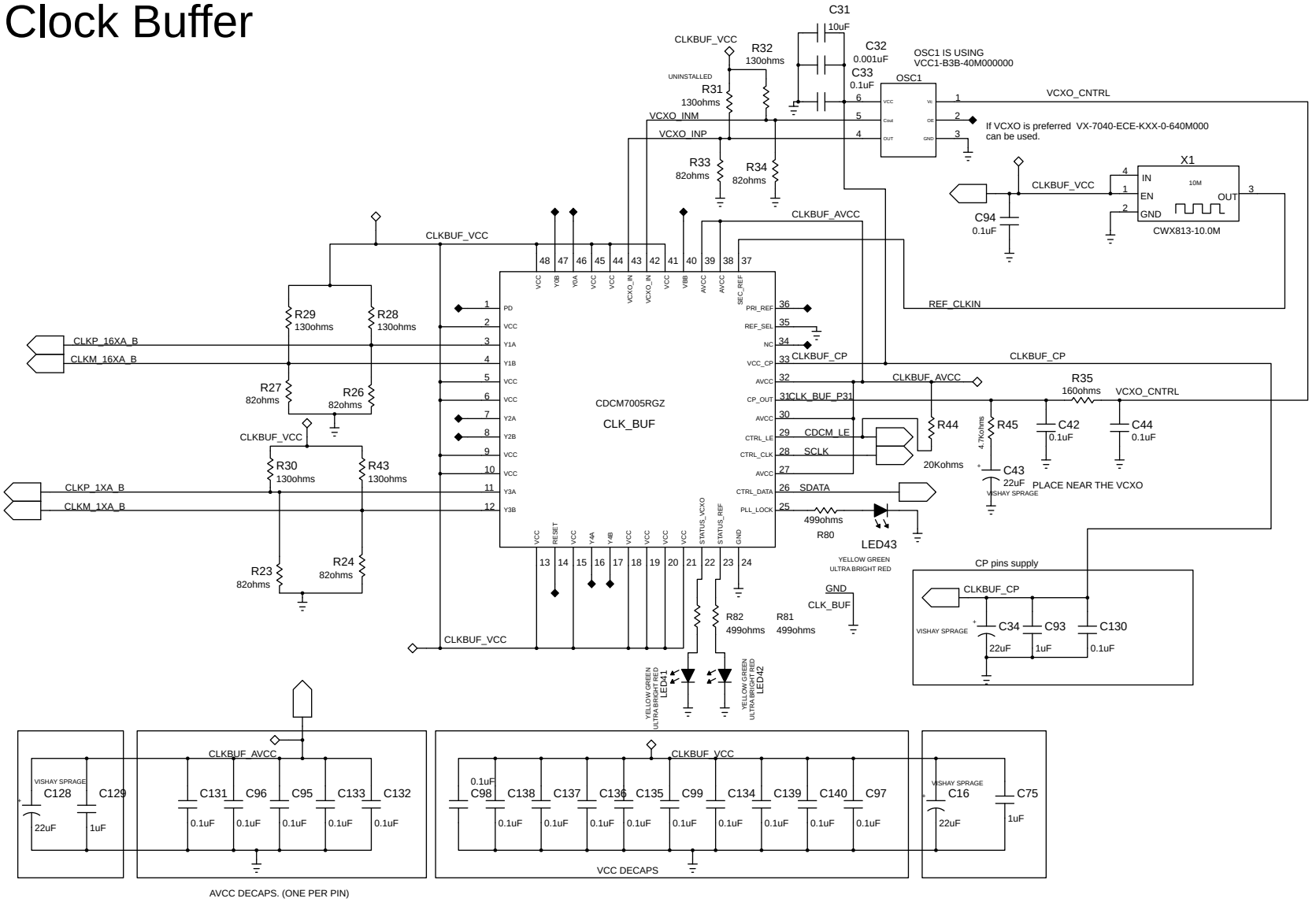


Figure 14. Schematic (Sheet 4 of 10)

ADC CLOCK

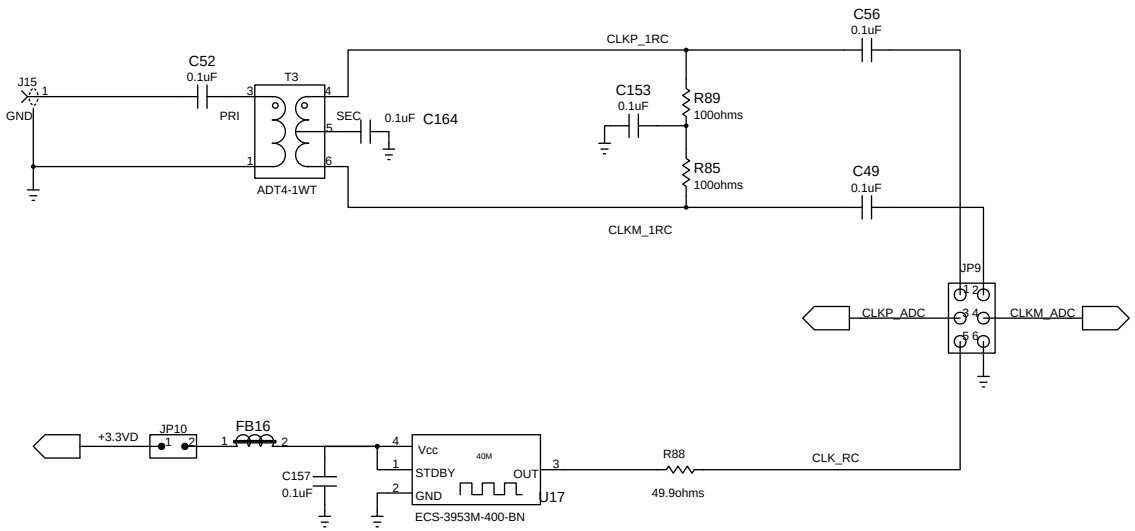


Figure 15. Schematic (Sheet 5 of 10)

CW CLK

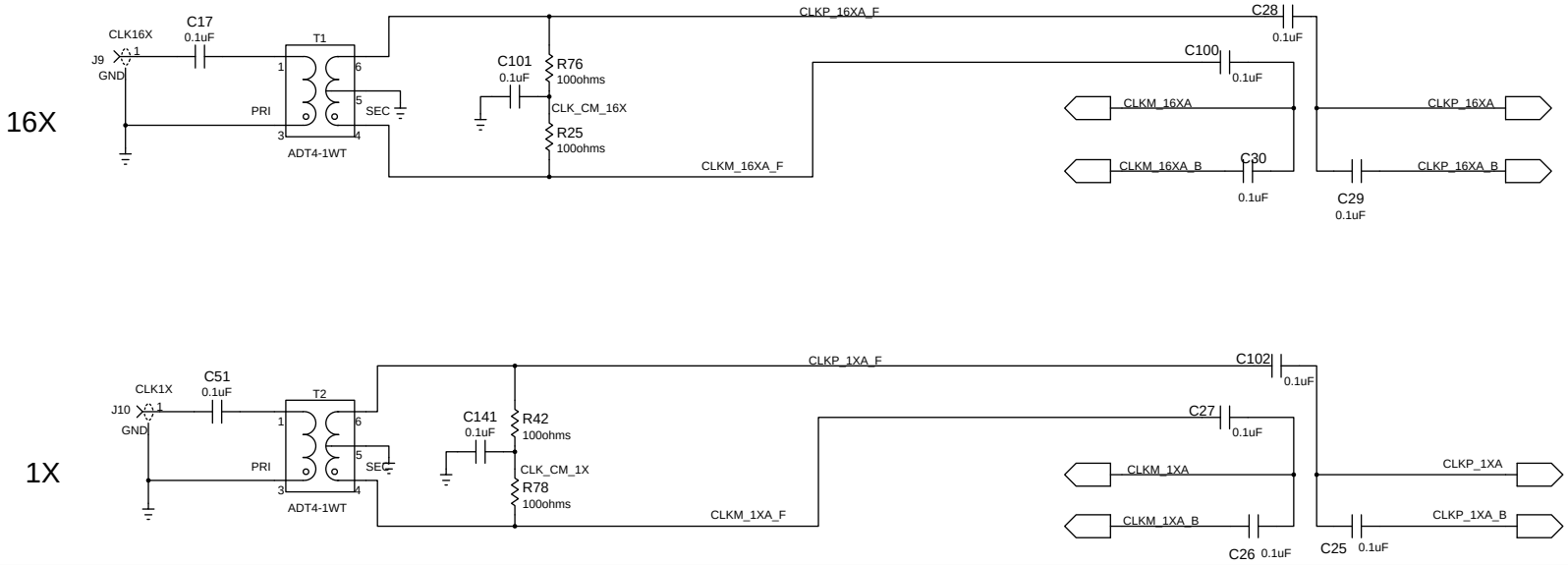


Figure 16. Schematic (Sheet 6 of 10)

VCON SINGLE TO DIFFERENTIAL CONVERTER

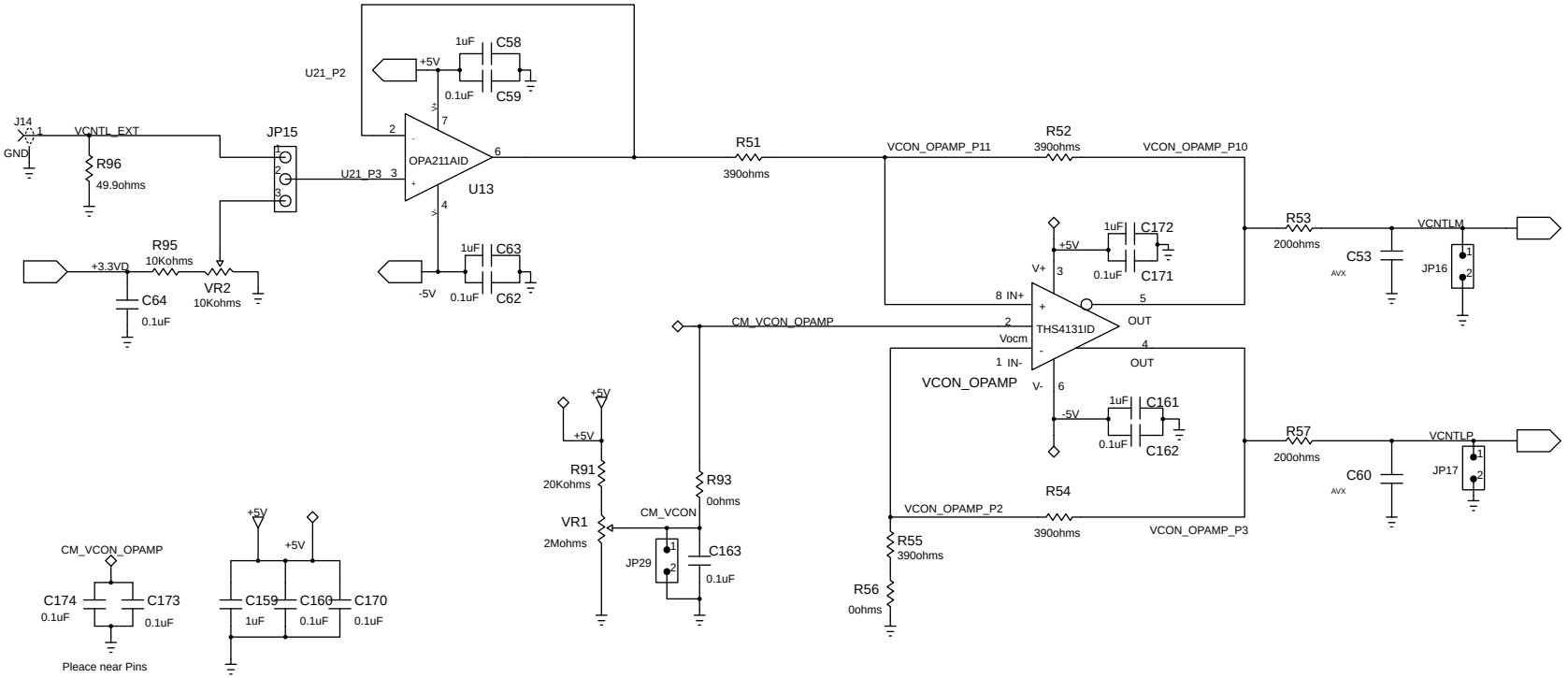


Figure 17. Schematic (Sheet 7 of 10)

CW Mixer Out

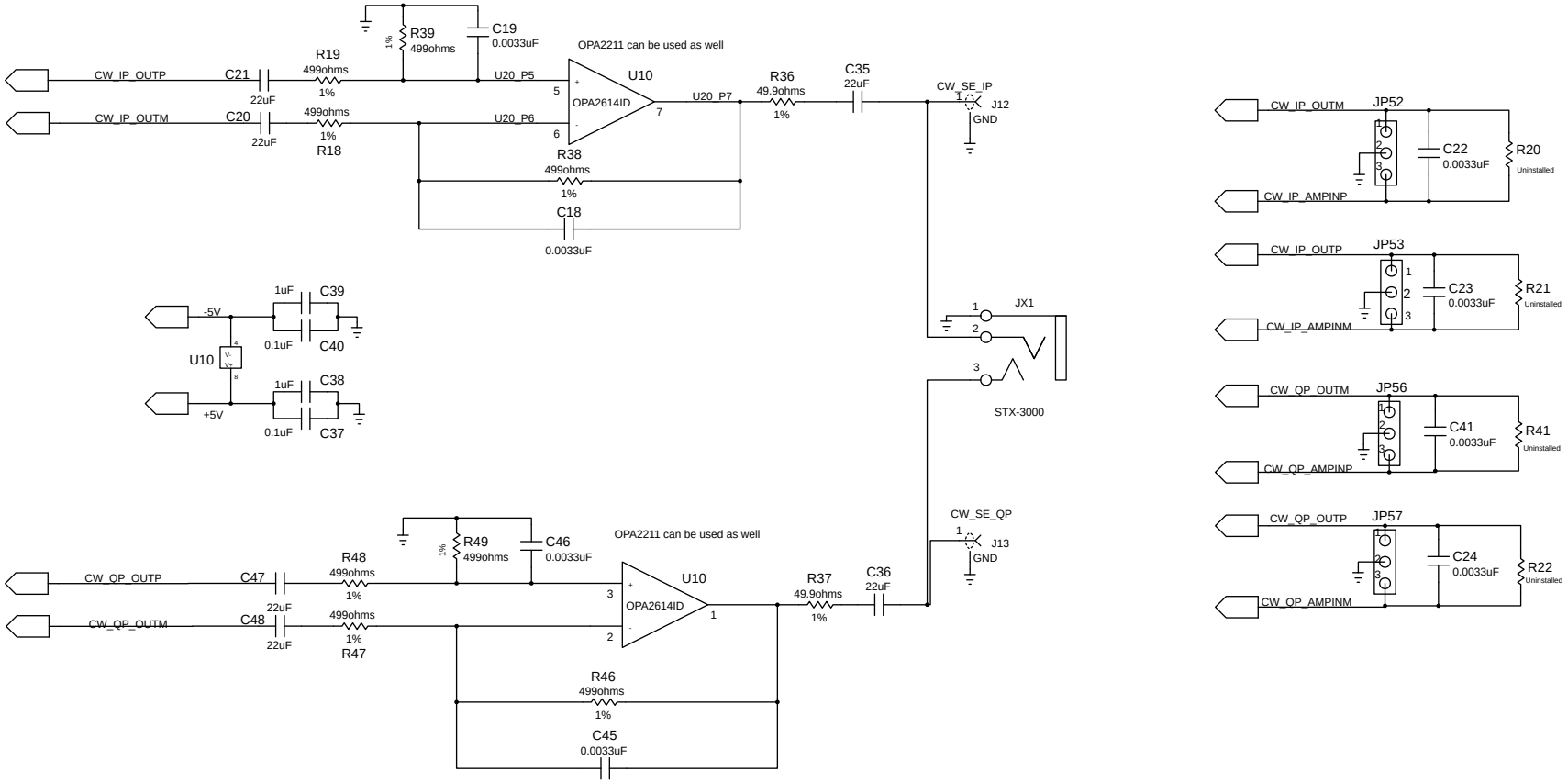
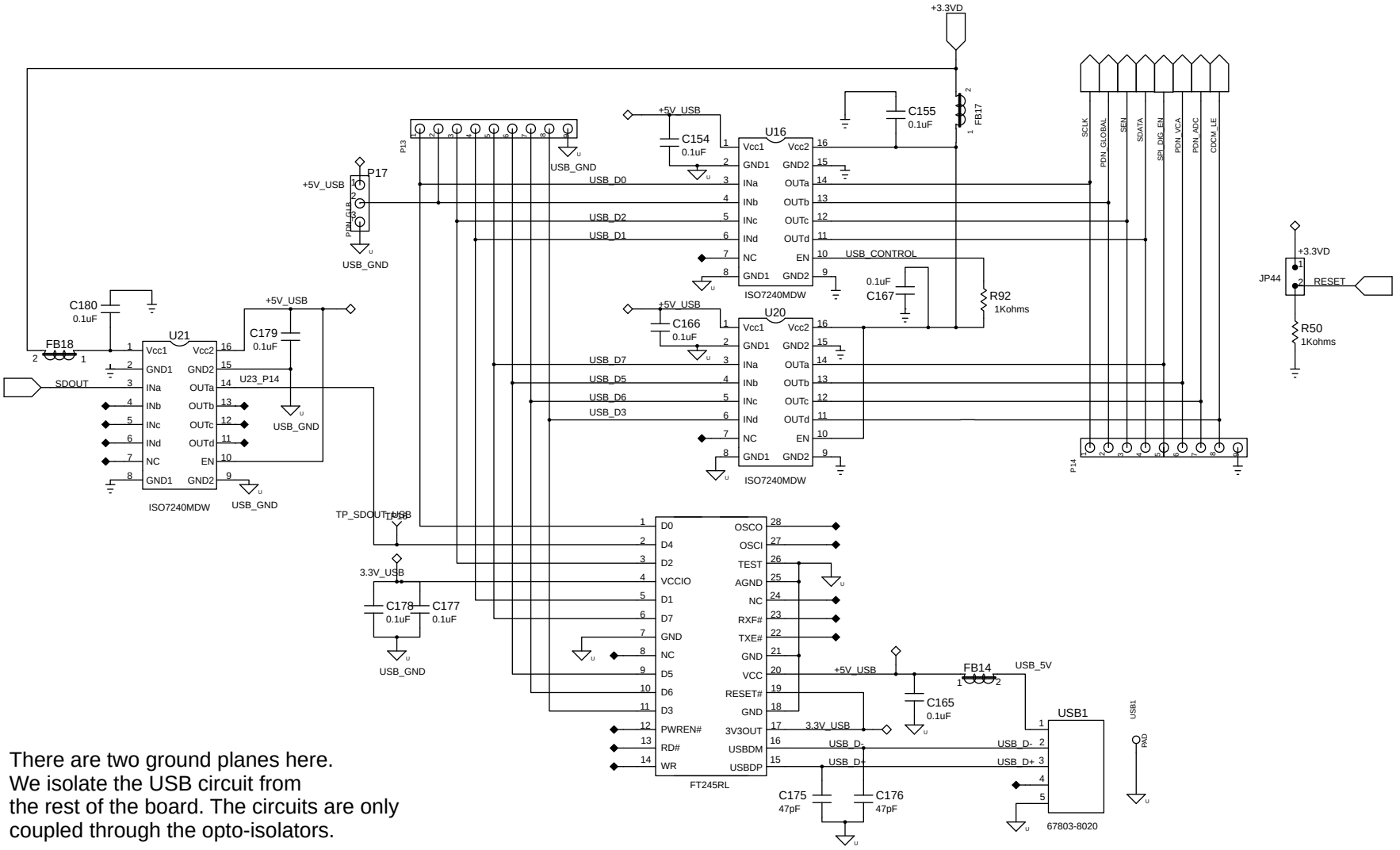


Figure 18. Schematic (Sheet 8 of 10)

Serial Interface



There are two ground planes here. We isolate the USB circuit from the rest of the board. The circuits are only coupled through the opto-isolators.

Figure 19. Schematic (Sheet 9 of 10)

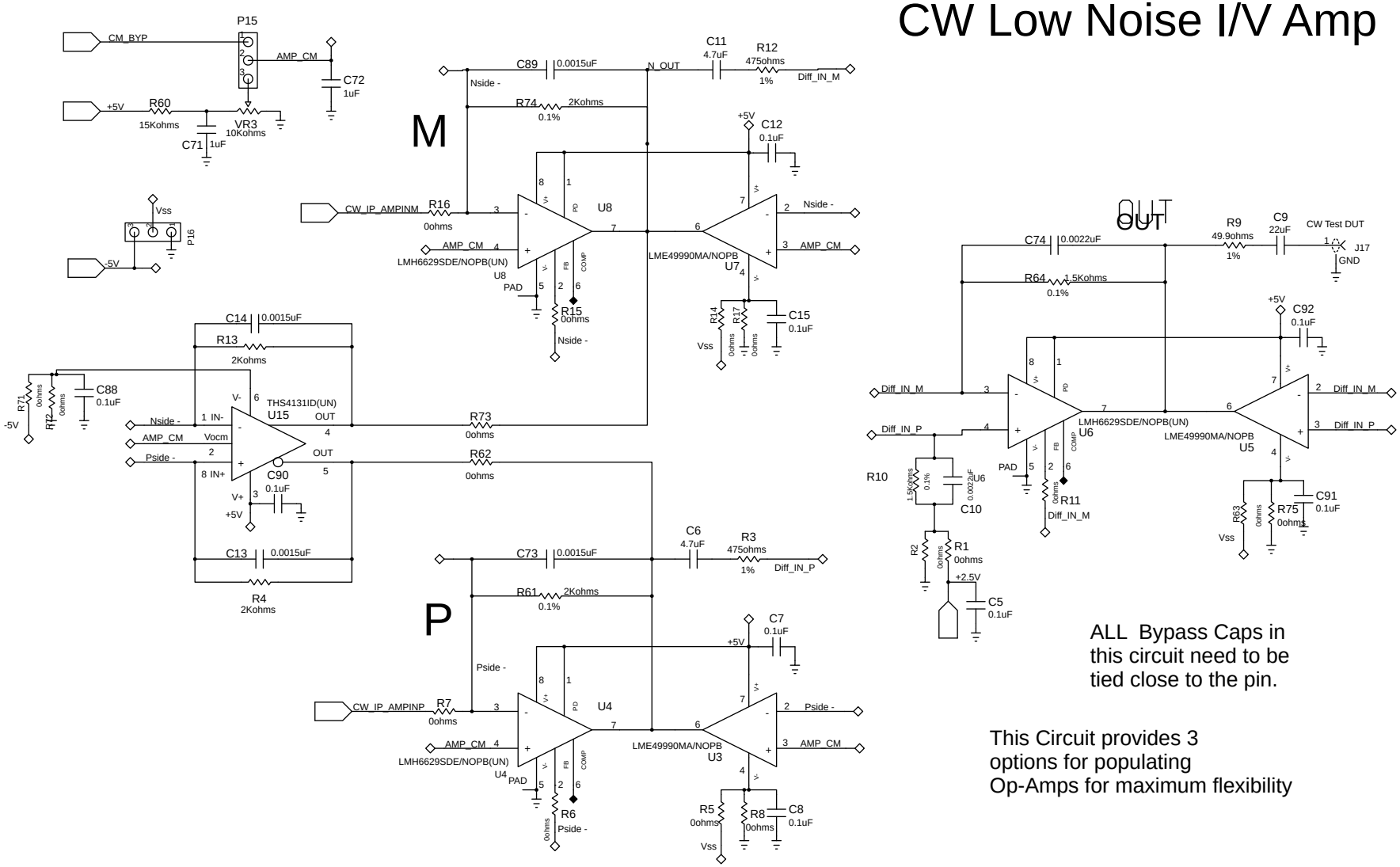


Figure 20. Schematic (Sheet 10 of 10)

6.4 Layout

Figure 21 through Figure 26 show the six layers of the AFE5812EVM board.

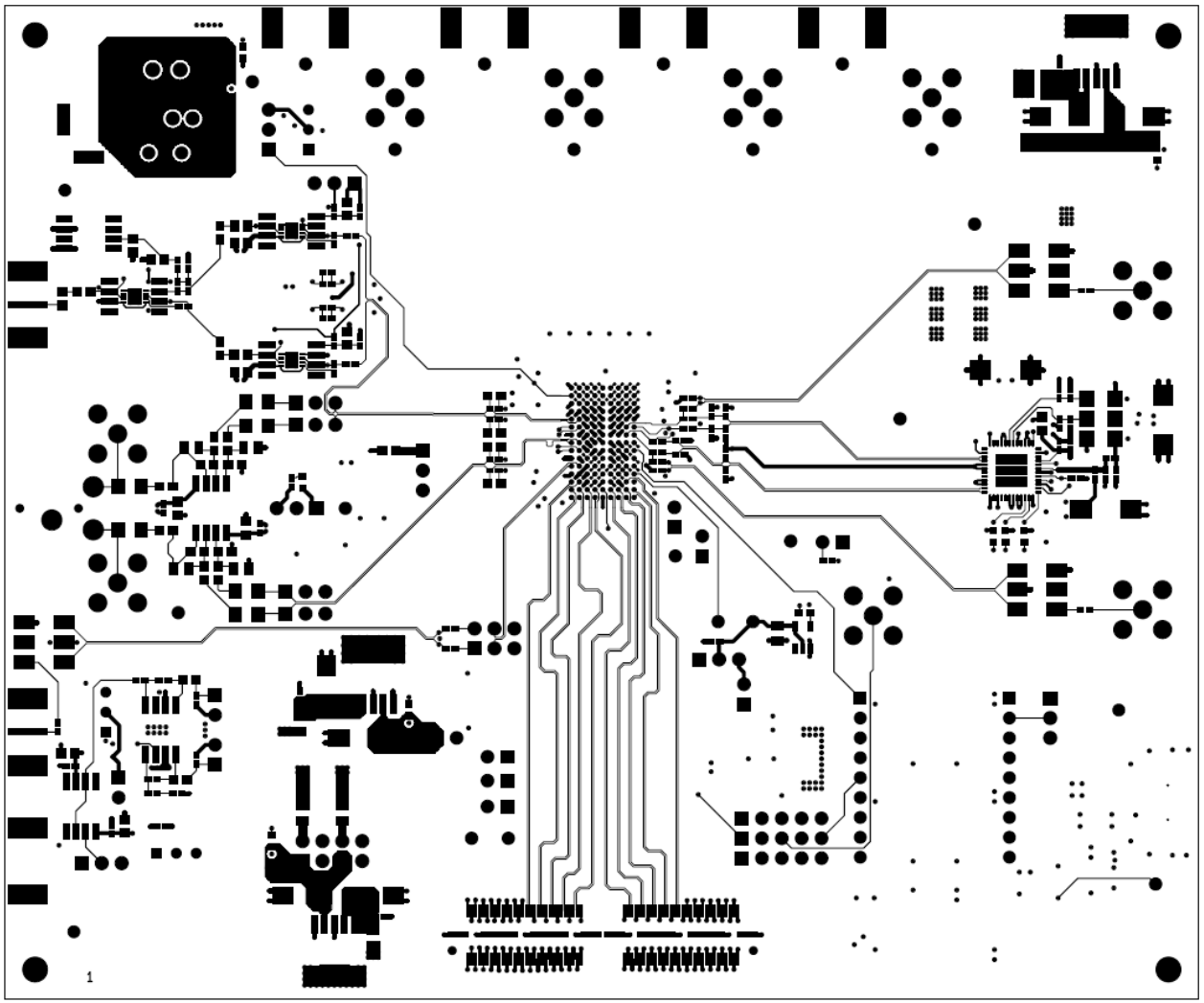


Figure 21. Top Layer - Signal

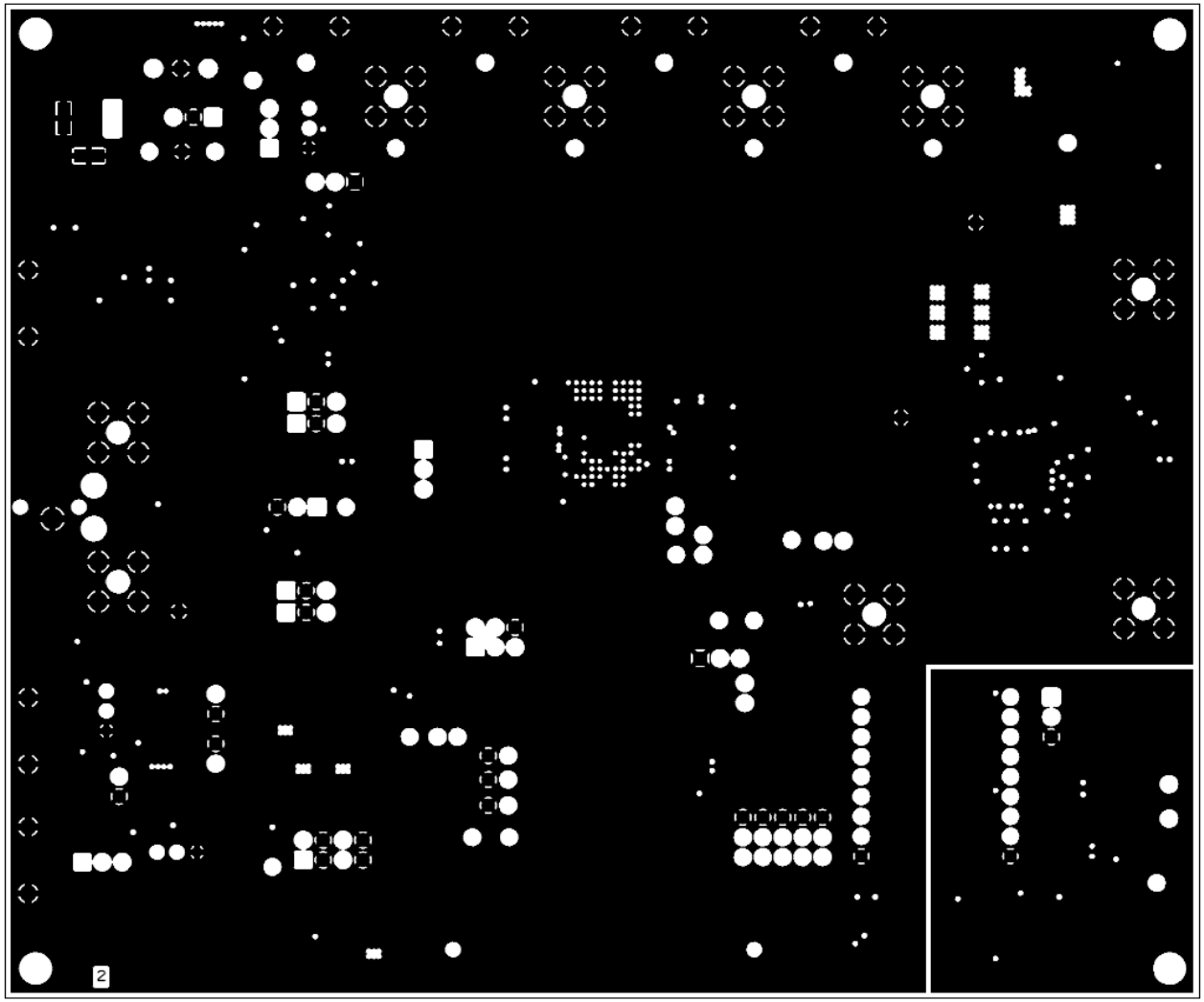


Figure 22. Second Layer - Ground

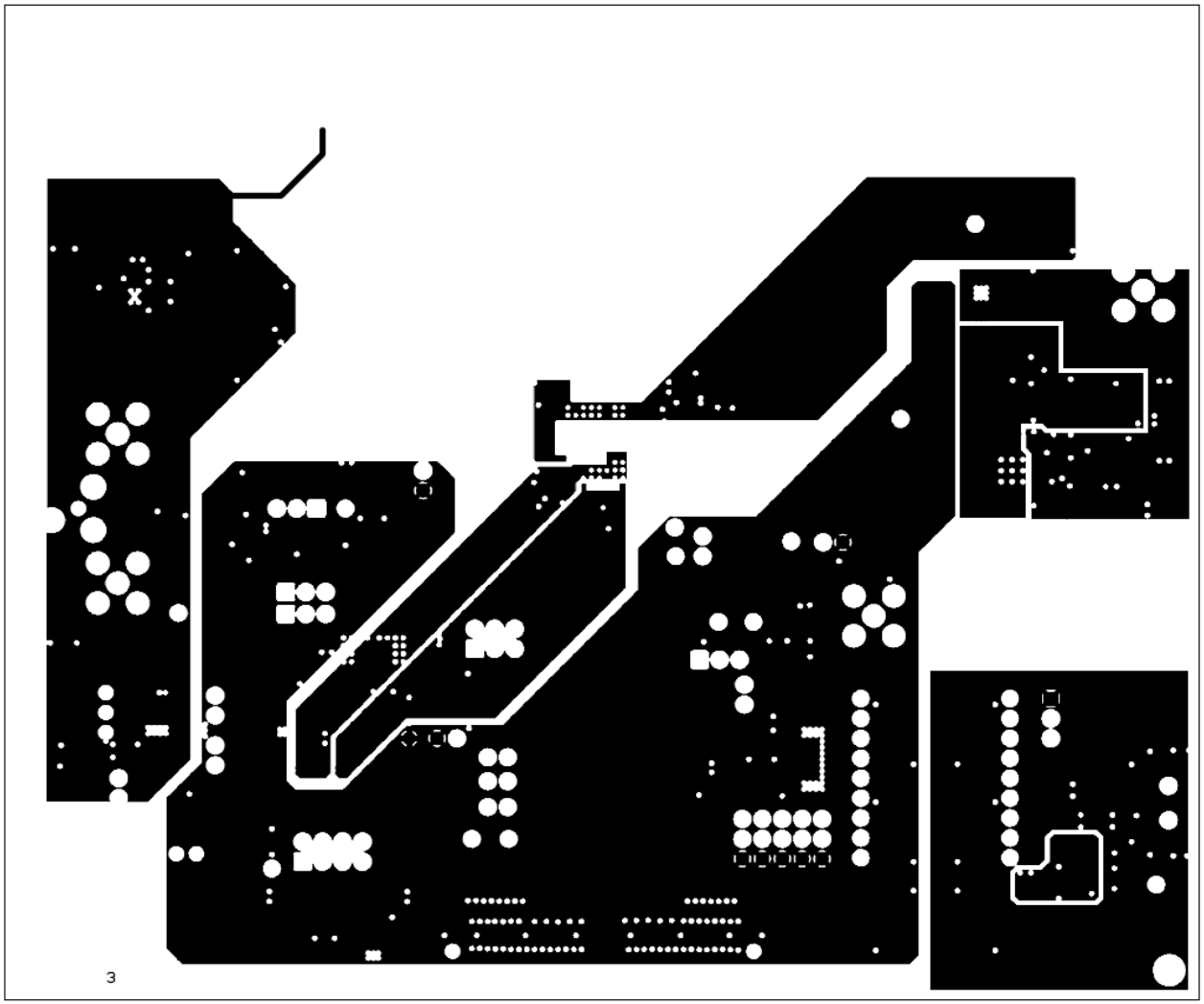


Figure 23. Third Layer - Power

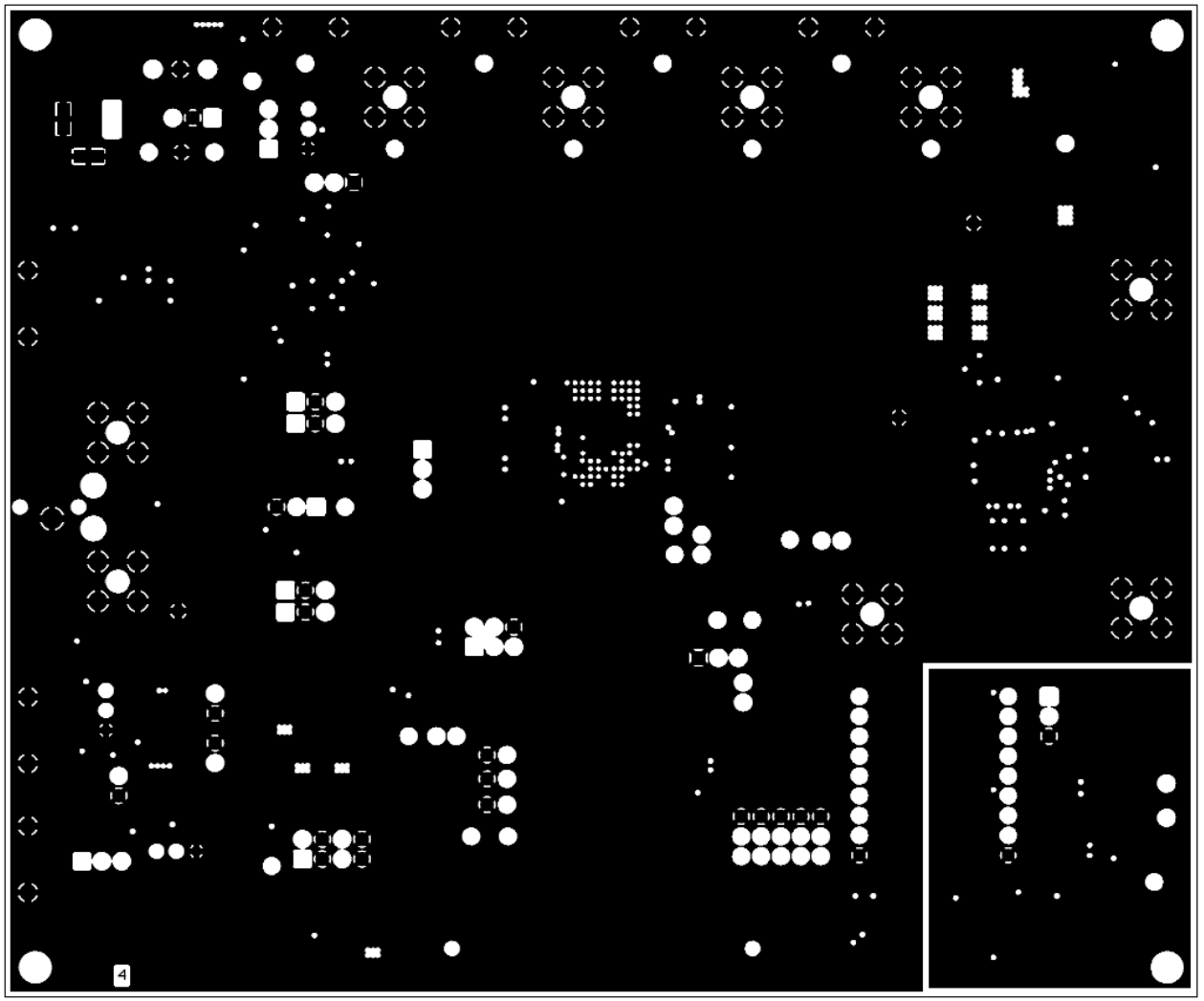


Figure 24. Fourth Layer - Signal

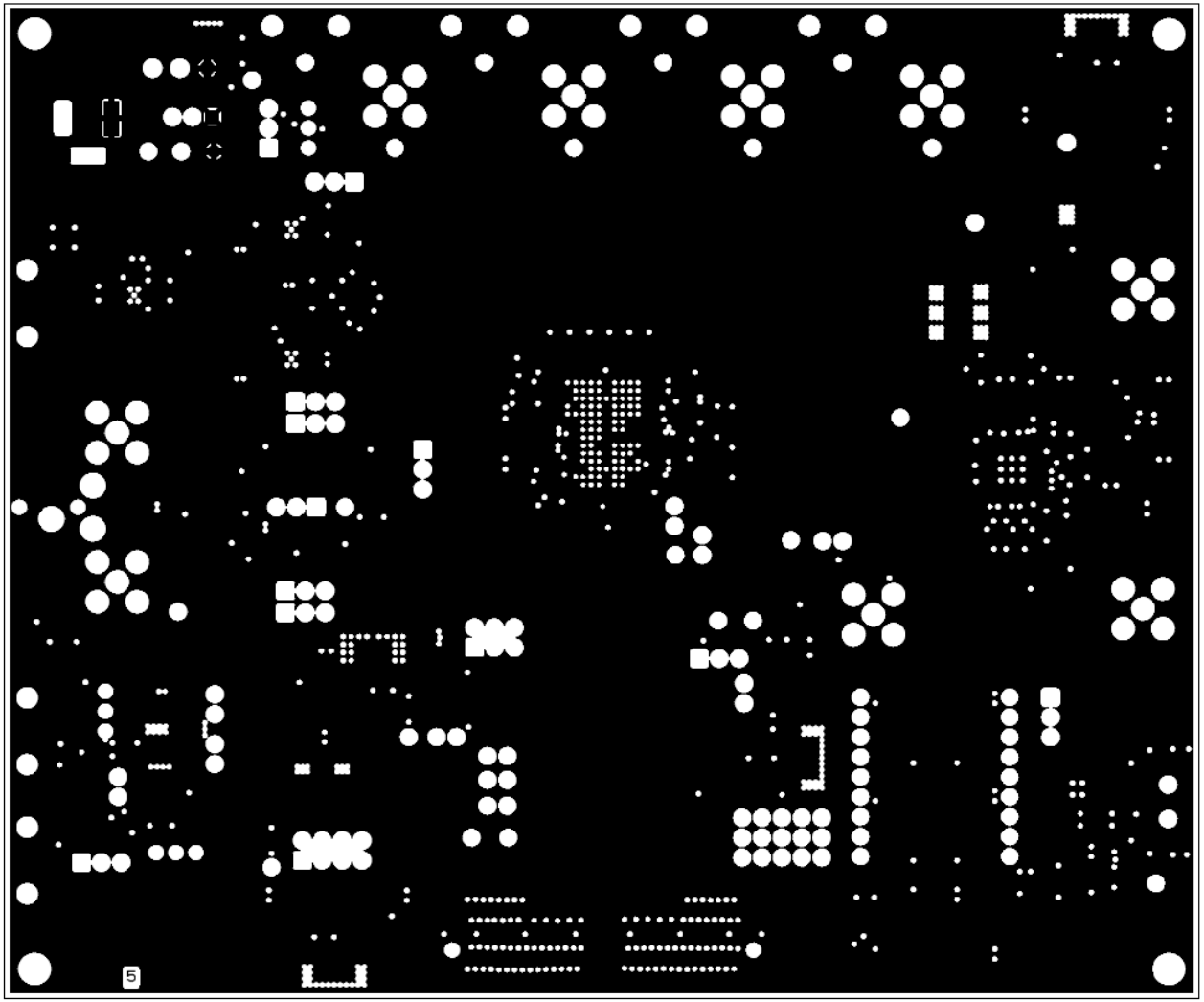


Figure 25. Fifth Layer - Ground

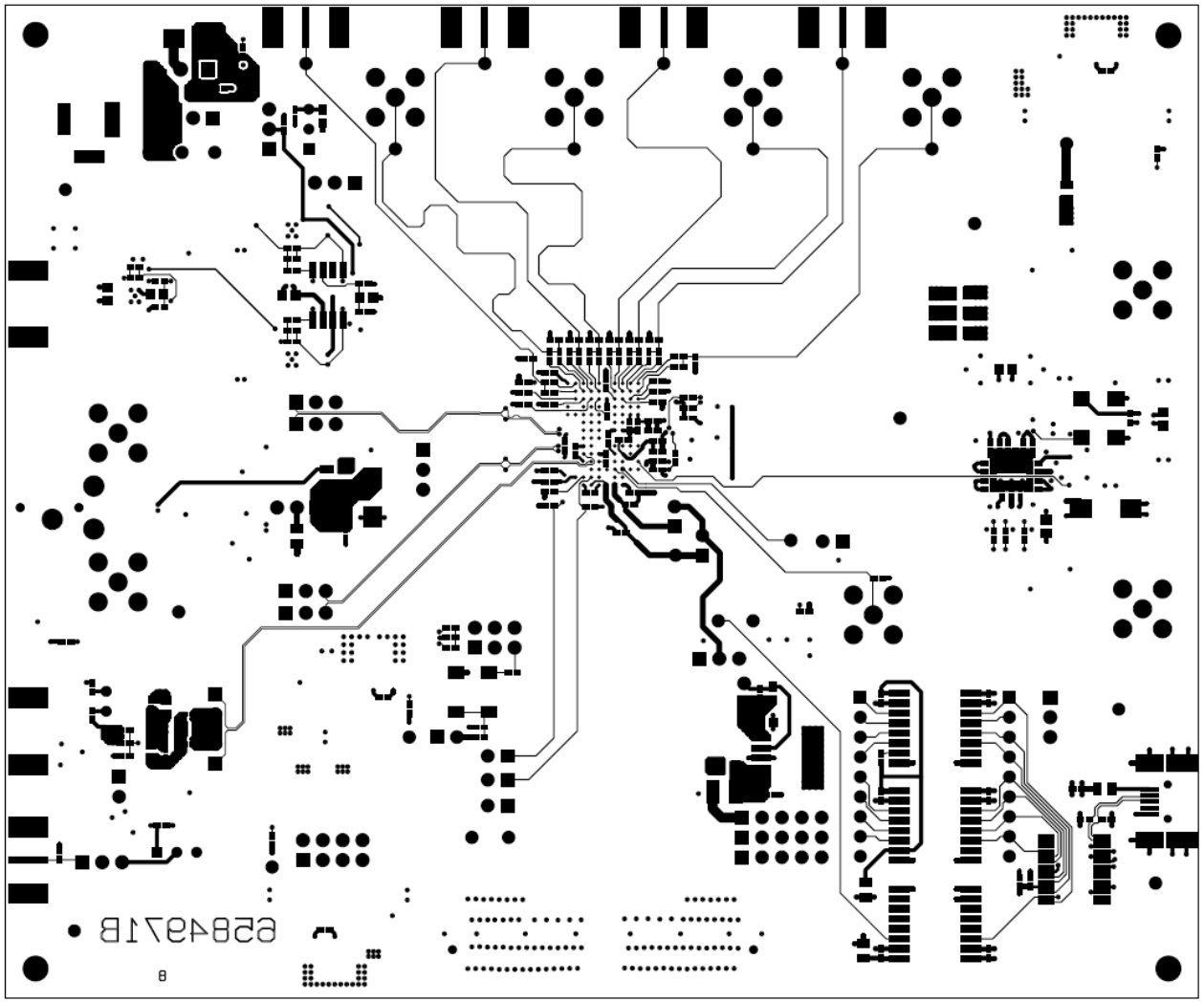


Figure 26. Bottom Layer - Signal

6.5 Bill of Materials

Table 3 lists the AFE5812EVM bill of materials (BOM).

Table 3. Bill of Materials

Item	QTY	MFG	MFG Part #	Reference Designator	Description	Value or Function
	REF	-	6584971B	-	ASSEMBLY	-
	REF	-	6584971B	-	SCHEMATIC	-
	1	TesSolve	6584971B	-	FABRICATION	-
	REF	-	6584971B	-	ARTWORK	-
1	82	AVX	0402YC104KAT2A	C17, C25, C26, C29, C30, C33, C37, C40, C49, C51, C52, C53, C56, C59, C60, C62, C64, C76, C78, C80, C82, C84, C86, C94, C95, C96, C97, C98, C99, C101, C103, C105, C106, C110, C111, C112, C113, C114, C115, C120, C122, C124, C125, C130, C131, C132, C133,	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,16V,10%,0.1uF
				C134, C135, C136, C137, C138, C139, C140, C141, C142, C143, C144, C145, C146, C147, C148, C149, C150, C153, C154, C155, C160, C162, C163, C164, C165, C166, C167, C170, C171, C173, C174, C177, C178, C179, C180		
2	2	AVX	0402YC222KAT2A	C10, C74	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,16V,10%,2200pF
3	11	KEMET	C0402C104K8PAC	C1, C54, C57, C67, C68, C69, C152, C157, C158, C168, C181	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,0.1uF,10V,10%,X5R
4	4	KEMET	C0402C152J5GACTU	C13, C14, C73, C89	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,1500pF,50V,5%,C0G/NP0
5	8	TDK	C1005X5R0J105M	C77, C79, C81, C83, C85, C87, C104, C126	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,1.0uF,6.3V,20%,X5R
6	4	SAMSUNG	CL05A105KP5NNN	C71, C72, C117, C127	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,1.0uF,10V,10%,X5R
7	1	SAMSUNG	CL05B102KB5NNNC	C32	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,1000pF,50V,10%,X7R
8	8	SAMSUNG	CL05B153KO5NNNC	C107, C108, C109, C116, C118, C119, C121, C123	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,15000pF,16V,10%,X7R
9	4	SAMSUNG	CL05B332KB5NNNC	C22, C23, C24, C41	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,3300pF,50V,10%,X7R
10	2	MURATA	GRM1555C1H470JA01D	C175, C176	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,47pF,50V,5%,NPO
11	1	MURATA	GRM1555C1H820JA01D	C156	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,82pF,50V,5%,NPO
12	9	AVX	06033C104JAT2A	C5, C7, C8, C12, C15, C88, C90, C91, C92	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,0.1uF,25V,5%,X7R
13	7	AVX	0603YD105KAT2A	C38, C39, C58, C63, C159, C161, C172	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,1.0uF,16V,10%,X5R
14	1	TAIYO YUDEN	AMK107BJ226MA-T	C9	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,22uF,4V,20%,X5R
15	1	PANASONIC	ECJ-1VB0J106M	C4	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,10uF,6.3V,20%,X5R
16	3	PANASONIC	ECJ-1VB1C105K	C75, C93, C129	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,1.0uF,16V,10%,X5R
17	2	MURATA	GRM188C80G475KE19	C6, C11	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,4.7uF,4V,10%,X6S (TI-F)
18	1	TAIYO YUDEN	JMK107BJ106MA-T	C31	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,10uF,6.3V,20%,X5R
19	4	KEMET	C0805C332F3GACTU	C18, C19, C45, C46	CAP,SMT,0805	CAPACITOR,SMT,0805,CERAMIC,3300pF,25V,1%,C0G(NP0)
20	6	MURATA	GRM31CR61A226KE19K	C20, C21, C35, C36, C47, C48	CAP,SMT,1206	CAPACITOR,SMT,1206,CERAMIC,22uF,10V,10%,X5R
21	1	AVX	1210ZG226ZAT2A	C169	CAP,SMT,1210	CAP,22uF,10V,+80~-20%
22	4	VISHAY SPRAGE	293D226X9016D2T	C16, C34, C43, C128	CAP,SMT,7343	CAP,TAN,SMT, 22uF,16V,+/-10%,-55~85C
23	1	AVX	TAJP106M010RNJ	C50	CAP,SMT,TAN,0805	CAP,SMT,TAN,0805,10uF,10V,20%,H-CASE
24	8	AVX	TPSC226K016R0375	C2, C3, C55, C61, C65, C66, C70, C151	CAPACITOR,SMT,TANT	10%, 16V, 22uF
25	7	EMERSON	142-0701-801	J2, J4, J6, J8, J14, J15, J17	CONN,END LAUNCH,SMA JACK	SMA JACK END LAUNCH, 0.062 PCB THICK
26	1	MOLEX	67803-8020	USB1	CONN,SMT,5P	MINI-AB USB OTG RECEPTACLE SMT TYPE

Table 3. Bill of Materials (continued)

Item	QTY	MFG	MFG Part #	Reference Designator	Description	Value or Function
27	1	SWITCHCRAFT	RAPC722X	J18	CONNECTOR,JACK	POWER JACK, MINI,R/A
28	9	AMPHENOL	901-144-8	J1, J3, J5, J7, J9, J10, J11, J12, J13	CONNECTOR,SMA	SMA COAX STRAIGHT PCB CURRENT P/N IS 901-144-8RFX
29	1	TEXAS INSTRUMENTS	AFE5812	DUT1	CUSTOMER PROVIDED	135-BGA
30	1	MURATA	BLM15BD102SN1D	FB16	FERRITE BEAD,SMT,0402	FERRITE BEAD,SMT,0402,1K OHM,200mA
31	17	LAIRD	HI0805R800R-10	FB1, FB2, FB3, FB4, FB5, FB6, FB7, FB8, FB9, FB10, FB11, FB12, FB13, FB14, FB15, FB17, FB18	FERRITE BEAD,SMT,2P	FERRITE,SMT,0805,80 OHM@100MHz,5A
32	1	MOLEX	39357-0003	P1	HEADER, THRU, 3P	HEADER, THRU, POWER, 3P,3.5MM, EUROSTYLE
33	1	SAMTEC	QTH-060-01-L-D-A	P10	HEADER,SMT,120P	HEADER,SMT,120P,0.5mm,FEM,2BANK,RECEPTACLE,168/198 H
34	1	SAMTEC	TSW-103-07-G-D	JP9	HEADER,THU	HEADER,THU,6P,2X3,MALE,DUAL ROW,100LS,100TL
35	1	SAMTEC	TSW-104-07-G-D	JP1	HEADER,THU	HEADER,THU,8P,2X4,MALE,DUAL ROW,100LS,100TL
36	3	TYCO ELECTRONICS	4-103239-0X5	J16, JP50, JP51	HEADER,THU,5P	HEADER, 1X5 .1CTRS
37	11	TYCO ELECTRONICS	4-103239-0x2	JP10, JP16, JP17, JP19, JP20, JP21, JP29, JP44, JP58, JP4A, JP4B	HEADER,THU,JUMPER	MALE,2PIN,.100CC MAKE FROM 4-103239-0x2
38	12	TYCO ELECTRONICS	4-103239-0x3	JP2, JP3, JP6, JP15, JP52, JP53, JP56, JP57, JP59, P15, P16, P17	HEADER,THU,JUMPER	MAKE FROM 4-103239-0
39	3	NATIONAL SEMI	LME49990MA/NOPB	U3, U5, U7	IC,SMT,8P	ULTRA LOW DISTORTION ULTRA LOW NOISE OPAMP
40	1	TEXAS INSTRUMENTS	CDCM7005RGZ	CLK_BUF	IC,SMT,QFN-48	3.3-V HIGH PERFORMANCE CLOCK SYNTHESIZER AND JITTER CLEANER
41	3	TI	ISO7240MDW	U16, U20, U21	IC,SMT,SOIC-16W	QUAD DIGITAL ISOLATORS
42	1	TI / BURR-BROWN	OPA211AID	U13	IC,SMT,SOIC-8	1.1nV/Hz NOISE LOW POWER PRECISION OPERATIONAL AMPLIFIER
43	1	TI	OPA2614ID	U10	IC,SMT,SOIC-8	DUAL HI GAIN BWIDTH HI OUTPUT CURRENT OPAMP WITH CURRENT LIMIT
44	1	BURR-BROWN / TI	REF5025AID	U2	IC,SMT,SOIC-8	LOW-NOISE VERY LOW DRIFT PRECISION VOLTAGE REFERENCE,2.5V
45	1	TI	THS4131ID	VCON_OPAMP	IC,SMT,SOIC-8	HIGH-SPEED LOW NOISE DIFFERENTIAL I/O AMPLIFIERS
46	1	TI	TPS79601DCQR	U18	IC,SMT,SOT223-6	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR,1.2-5.5V
47	1	TI	TPS79618DCQR	U14	IC,SMT,SOT223-6	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR,1.8V
48	2	TI	TPS79633DCQR	U1, U12	IC,SMT,SOT223-6	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR,3.3V
49	1	TI	SN74LVC1G06DBV	U11	IC,SMT,SOT23-5	SINGLE INVERTER BUFFER / DRIVER WITH OPEN-DRAIN OUTPUT
50	1	FUTURE TECHNOLOGY DEVICE INT.	FT245RL	U19	IC,SMT,SSOP-28	USB FIFO IC INCORPORATE FTDICHIP-ID SECURITY DONGLE
51	8	PANASONIC	LNJ326W83	LED41, LED42, LED43, LED-5V, LED33VA, LED33VD, LED5V, LED_LDO	LED,SMT,0603	LED,SMT,0603,YELLOW GREEN,2.05V
52	1	PANASONIC	LNJ826W86RA	LED18VA	LED,SMT,0603	LED,SMT,0603,ORANGE,1.92V
53	1	CONNOR WINFIELD	CWX813-10.0M	X1	OSC,SMT,4P	OSCILLATOR,SMT,4P,3.3V,+/-25ppm,-20~70C,10.000 MHz
54	1	OSC,SMT,6P	VX-7040-ECE-KXX-0-640M000	OSC1	OSC,SMT,6P	VCXO,SMT,3.3V,640Mhz 5.0x7.5x1.8mm (Customer Supply)
55	1	ECS	ECS-3953M-400-BN	U17	OSCILLATOR,SMT,4P	OSC,SMT,3.3V,50ppm,-40~85C,5nS,40.000 MHz
56	7	VISHAY	CRCW04020000Z0ED	R2, R5, R7, R14, R63, R71, R93	RES,SMT,0402	ZERO OHM JUMPER,SMT,0402,THICK FILM,0 OHM,1/16W,5%
57	1	VISHAY	CRCW040210K0FKED	R95	RES,SMT,0402	RESISTOR,SMT,0402,10K,1/16W,1%,100ppm

Table 3. Bill of Materials (continued)

Item	QTY	MFG	MFG Part #	Reference Designator	Description	Value or Function
58	2	VISHAY	CRCW04021K00FKED	R50, R92	RES,SMT,0402	RESISTOR,SMT,0402,1K,1/16W,1%,100ppm
59	2	VISHAY	CRCW04021K50FKED	R10, R64	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,1.5 K,1%,1/16W,100ppm
60	2	VISHAY	CRCW040220K0FKED	R44, R91	RES,SMT,0402	RESISTOR,SMT,0402,20K,1/16W,1%,100ppm
61	3	VISHAY	CRCW0402499RFKED	R80, R81, R82	RES,SMT,0402	RESISTOR,SMT,0402,499 OHM,1/16W,1%,100ppm
62	1	VISHAY	CRCW0402511RFKED	R58	RES,SMT,0402	RESISTOR,SMT,0402,511 OHM,1/16W,1%,100ppm
63	1	PANASONIC	ERJ-2GE0R00X	R56	RES,SMT,0402	RESISTOR/JUMPER,SMT,0402,0 OHM,5%,1/16W
64	5	PANASONIC	ERJ-2GEJ131	R28, R29, R30, R32, R43	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,130
65	4	PANASONIC	ERJ-2GEJ391	R51, R52, R54, R55	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,5%,1/16W,390
66	5	PANASONIC	ERJ-2GEJ820X	R23, R24, R26, R27, R34	RES,SMT,0402	RESISTOR,SMT,0402,THICK FILM,82 OHM,5%,1/10W
67	8	PANASONIC	ERJ-2RKF1000X	R25, R40, R42, R76, R78, R84, R85, R89	RES,SMT,0402	RESISTOR,SMT,0402,100 OHM,1%,1/10W
68	3	PANASONIC	ERJ-2RKF3320X	R59, R90, R94	RES,SMT,0402	RESISTOR,SMT,0402,332 OHM,1%,1/16W
69	2	PANASONIC	ERJ-2RKF49R9X	R88, R96	RES,SMT,0402	RESISTOR,SMT,0402,49.9 OHM,1%,1/16W
70	2	SUSUMU	RG1005N202B	R61, R74	RES,SMT,0402	RESISTOR,SMT,0402,THIN FILM,2 K,0.1%,1/16W,10ppm
71	1	VISHAY	CRCW06032002F	R97	RES,SMT,0603	RESISTOR,SMT,0603,1%,1/10W,20.0K
72	2	VISHAY	CRCW0603200RFKEA	R53, R57	RES,SMT,0603	RESISTOR,SMT,0603,THICK FILM,200 OHM,1%,1/10W
73	1	VISHAY	CRCW060330K1FKEA	R87	RES,SMT,0603	RESISTOR,SMT,0603,1%,1/10W,30.1K
74	2	VISHAY	CRCW0603475RFKEA	R3, R12	RES,SMT,0603	RESISTOR,SMT,0603,THICK FILM,475 OHM,1%,1/10W,100ppm
75	8	VISHAY	CRCW0603499RFKEA	R18, R19, R38, R39, R46, R47, R48, R49	RES,SMT,0603	RESISTOR,SMT,0603,THICK FILM,499 OHM ,1%,1/10W,100ppm
76	3	VISHAY	CRCW060349R9FKEA	R9, R36, R37	RES,SMT,0603	RESISTOR,SMT,0603,THICK FILM,49.9 OHM,1%,1/10W,100PPM
77	1	VISHAY	CRCW06034K32FKEA	R86	RES,SMT,0603	RESISTOR,SMT,0603,1%,1/10W,4.32K
78	1	PANASONIC	ERJ-3GSYJ153	R60	RES,SMT,0603	RESISTOR,SMT,0603,5%,1/10W,15K
79	1	KYCON	STX-3000	JX1	STEREO PHONE JACK,THU,3 PIN	STEREO PHONE JACK,THU,3 PIN,3.5mm
80	7	KEYSTONE ELECTRONICS	5000	TP2, TP13, TP14VD, TP18VD, TP33VA, TP33VD, TP5V	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS,120TL, RED
81	4	KEYSTONE ELECTRONICS	5001	GND1, GND2, GND3, GND4	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS,120TL, BLACK
82	2	KEYSTONE ELECTRONICS	5002	TP1, TP-5V	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS,120TL, WHITE
83	13	KEYSTONE ELECTRONICS	5004	TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP14, TP15, TP16	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS,120TL, YELLOW
84	3	MINI-CIRCUITS	ADT4-1WT	T1, T2, T3	TRANSF,SMT,6P	RF TRANSFORMER WIDEBAND, 2-775 MHz, 50 OHM
85	2	BOURNS	3296W-1-103	VR2, VR3	TRIMPOT,THU,3P	TRIMPOT,THU,10K,10%,0.5W,100ppm,25T
86	1	BOURNS	3296W-1-205	VR1	TRIMPOT,THU,3P	TRIMPOT,THU,2M,10%,0.5W,100ppm,25T
87	6	UNINSTALLED	0402YC104KAT2A(UN)	C27, C28, C42, C44, C100, C102	UNINSTALLED	UNINSTALLED
88	2	UNINSTALLED	8431-1x9(UN)	P13, P14	UNINSTALLED	UNINSTALLED
89	11	UNINSTALLED	CRCW04020000Z0ED(UN)	R1, R6, R8, R11, R15, R16, R17, R62, R72, R73, R75	UNINSTALLED	UNINSTALLED
90	1	UNINSTALLED	CRCW04024701F100(UN)	R45	UNINSTALLED	UNINSTALLED
91	1	UNINSTALLED	ERJ-2GEJ131(UN)	R31	UNINSTALLED	UNINSTALLED
92	1	UNINSTALLED	ERJ-2GEJ161(UN)	R35	UNINSTALLED	"UNINSTALLED "
93	8	UNINSTALLED	ERJ-2GEJ49R9(UN)	R65, R66, R67, R68, R69, R70, R77, R79	UNINSTALLED	"UNINSTALLED "
94	1	UNINSTALLED	ERJ-2GEJ820X(UN)	R33	UNINSTALLED	UNINSTALLED

Table 3. Bill of Materials (continued)

Item	QTY	MFG	MFG Part #	Reference Designator	Description	Value or Function
95	1	UNINSTALLED	ERJ-2RKF49R9X(UN)	R83	UNINSTALLED	UNINSTALLED
96	3	UNINSTALLED	LMH6629SDE/NOPB(UN)	U4, U6, U8	UNINSTALLED	UNINSTALLED
97	2	UNINSTALLED	RG1005N202B(UN)	R4, R13	UNINSTALLED	UNINSTALLED
98	1	UNINSTALLED	THS4131ID(UN)	U15	UNINSTALLED	UNINSTALLED
99	4	UNINSTALLED	ERJ-3GSYJ102(UN)	R20, R21, R22, R41	UNINSTALLED	UNINSTALLED
	4	KEYSTONE ELECTRONICS	2029	Standoffs		

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from A Revision (December 2015) to B Revision	Page
• Removed language indicating the wall supply is included in the kit.	6

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      CAUTION

      This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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