User's Guide
SLAU355A–July 2011–Revised March 2015

ADS5294, 8-Channel, Analog-to-Digital Converter Evaluation Module

This user's guide gives a general overview of the evaluation module (EVM) and provides a general description of the features and functions to be considered while using this module. This manual is applicable to the ADS5294 analog-to-digital converters (ADC), which collectively are referred to as ADS529x. Use this document in combination with the respective ADC data sheet. The ADS529xEVM provides a platform for evaluating the ADC under various signal, clock, reference, and power supply conditions.

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1 Quick View of Evaluation Setup

Figure 1 shows an overview of the evaluation setup that includes the ADS5294EVM evaluation module (EVM), TSW1400EVM, external equipment, personal computer (PC), and software requirements.

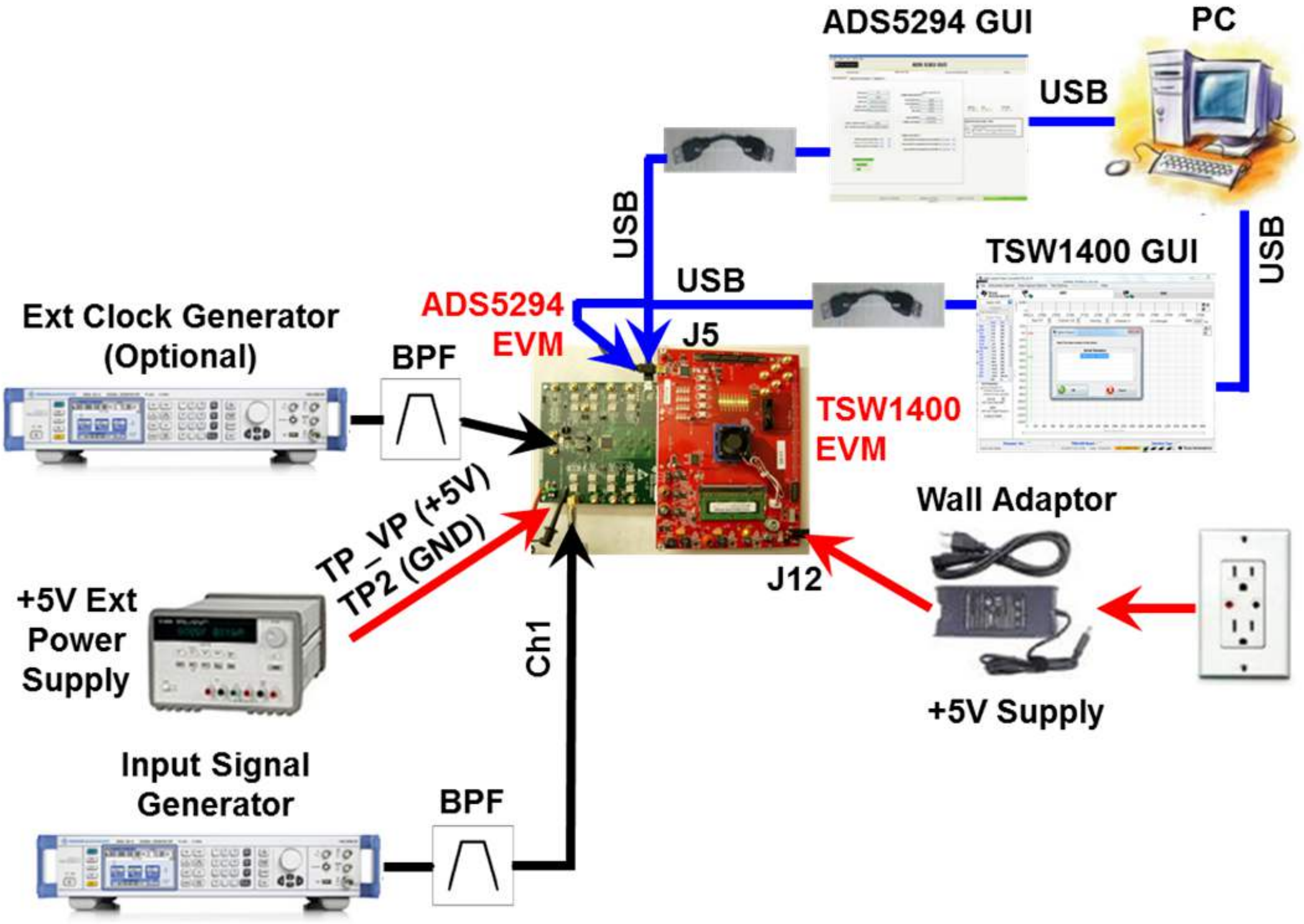


Figure 1. Evaluation Setup

TSW1400EVM: The high-speed LVDS deserializer board is required for capturing data from the ADS5294EVM and its analysis using the TSW1400 graphical user interface (GUI).

For more information pertaining to be TSW1400EVM, see: http://www.ti.com/tool/tsw1400evm.

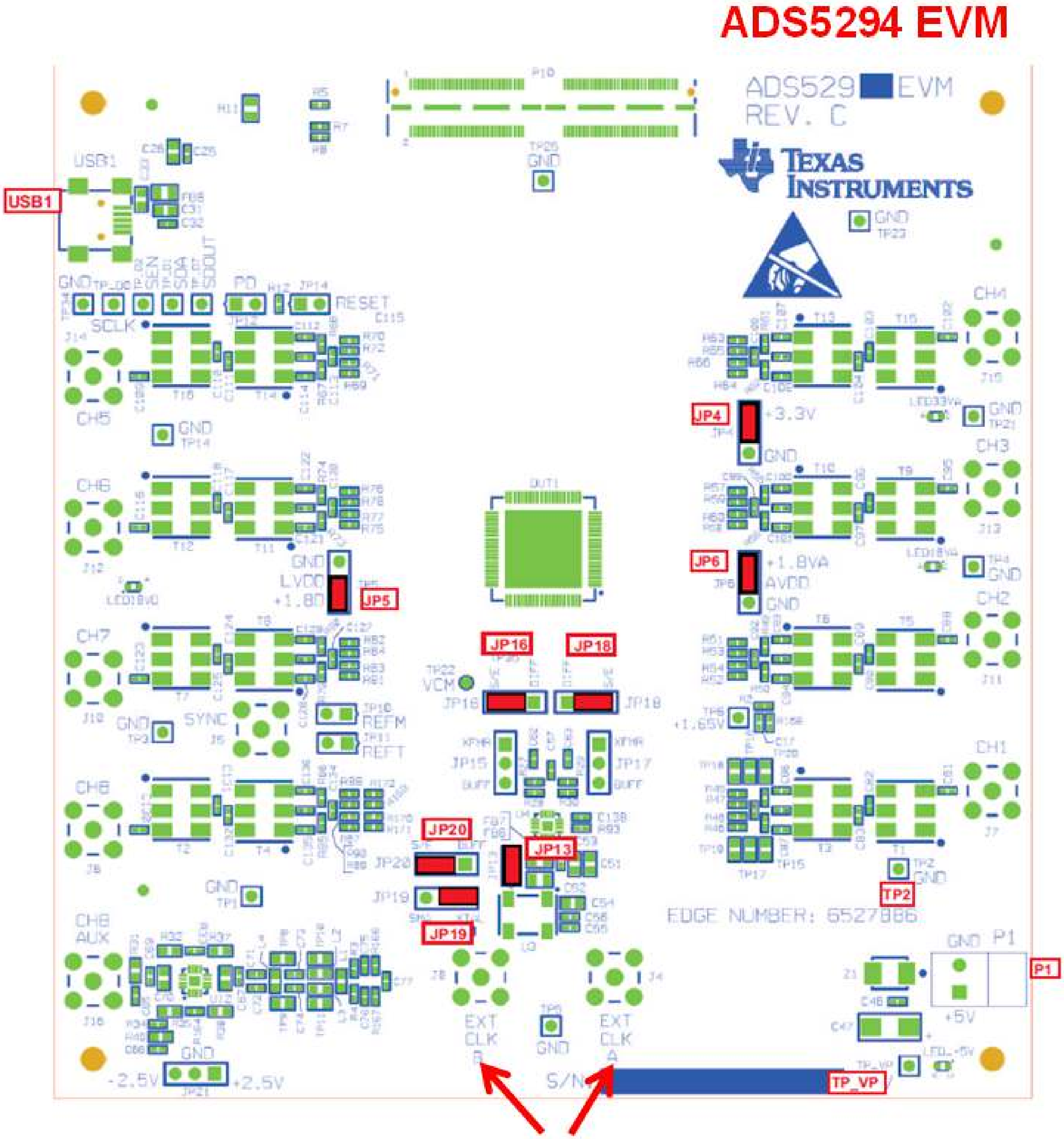
Equipment: Signal generators (with low-phase noise) must be used as source of input signal and clock (optional) in order to get the desired performance. Additionally, band-pass filters (BPF) are required in signal and clock (optional) paths to attenuate the harmonics and noise from the generators.

Power Supply: A single +5-V supply powers the ADS5294EVM. The supplies for the ADS5294 device are derived from the +5-V supply. The power supply must be able to source up to 1.5 A. A +6-V supply can power the TSW1400EVM using a wall adapter.

USB Interface to PC: The USB connection from the ADS5294EVM and TSW1400EVM to the personal computer (PC) must be set up; Section 3.2 explains the USB driver installation.

ADS5294GUI: Section 3.1 explains the GUI installation procedure and its operation.

2 Default Configuration



(Optional) 80MHz to EXT CLK A or B

Figure 2. ADS5294EVM Basic Configuration

1. The ADS5294EVM basic configuration uses the onboard single-ended clock as the default option. See Section 9.2 for the ADC clock, various-mode jumper settings.
2. P1: +5-V Power supplies the connector.
3. JP4, JP5, and JP6 are set to enable +3.3V Analog, +1.8VD Digital, and +1.8VA Analog to device,

respectively.

4. JP13: Enable onboard CMOS clock.
5. JP16, JP18, JP19, JP20: ADC clock source selection jumpers.

3 Software Installation and Operation

The ADS5294EVM comes with a software install. To Dowload the software, visit the ADS5294 product folder under *Tools & software* .

3.1 GUI Installation – Mandatory

Once the zip folder is downloaded, run setup.exe to install the software. The software to use the TSW1400EVM is called HSDCPro (High Speed Data Converter Pro). For information on how to download this software, please see Appendix A.

3.2 USB Interface Driver Installation

- Connect the USB port of EVM to your PC.
- If the driver has not been installed, then the message *Window Found New Hardware* appears. The Wizard as shown in the following illustration launches. Otherwise, skip Section 3.2 and go to Section 4.
- Select *No, not this time* from the options. Press Next button

Welcome to the Found New Hardware Wizard

Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).

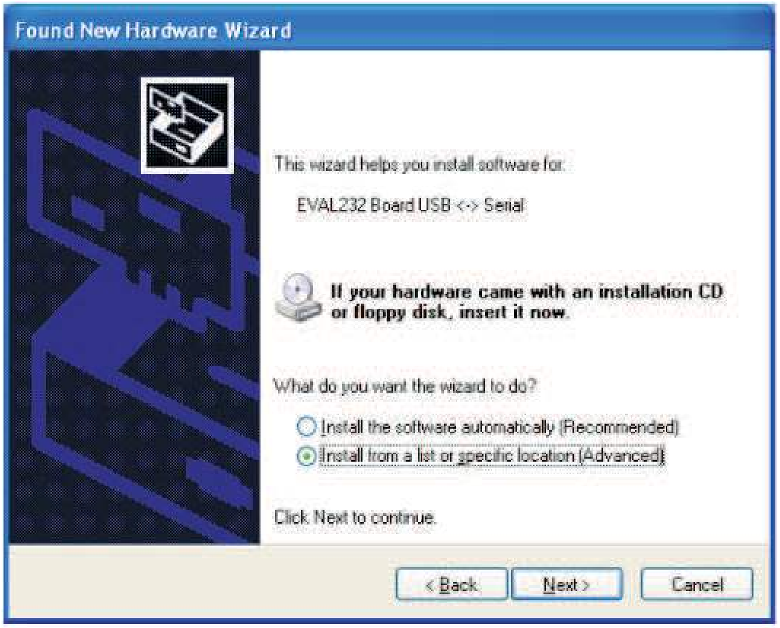
Read our privacy policy

Can Windows connect to Windows Update to search for software?

○ Yes, this time only
○ Yes, now and every time I connect a device
● No, not this time

Click Next to continue.

- Select *Install from a list or specific location (Advanced)* as shown in the following illustration, and then click *Next.*



Found New Hardware Wizard

This wizard helps you install software for:

EVAL232 Board USB <-> Serial

If your hardware came with an installation CD or floppy disk, insert it now.

What do you want the wizard to do?

○ Install the software automatically (Recommended)

● Install from a list or specific location (Advanced)

Click Next to continue.

- Select *Search for the best driver in these locations*, and enter the file path for (C:\Program Files\Texas Instruments\ADS 5294EVM\CDM 2.04.06 WHQL Certified) in the combo-box. or browse to it by clicking the browse button. Once the file path has been entered in the box, click *Next* to proceed.
- If Windows™ XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, the following screen is displayed unless installing a Microsoft™ WHQL-certified Driver. Click on *Continue Anyway* to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message appears.

Hardware Installation

The software you are installing for this hardware:

USB Serial Converter

has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)

Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.

4 Test Setup

To evaluate the ADS5294 device, a TSW1400EVM is required. Figure 3 shows the exact setup of these two boards and external connectors.

- Connect +5-V supply at **P1** connector or across TP_VP (+5V) and TP2 (GND).
- Connect USB cable from PC to **USB1** on ADS5294EVM.
- Connect ADS5294EVM to TSW1400EVM using **P10** connector.
- Connect USB cable from PC to USB port **J8** of TSW1400EVM.
- Connect +6-V wall adapter to TSW1400EVM at **J7** connector.

For the default configuration as shown in Figure 2, it is unnecessary to have an external sampling clock. The onboard CMOS clock oscillator is used.

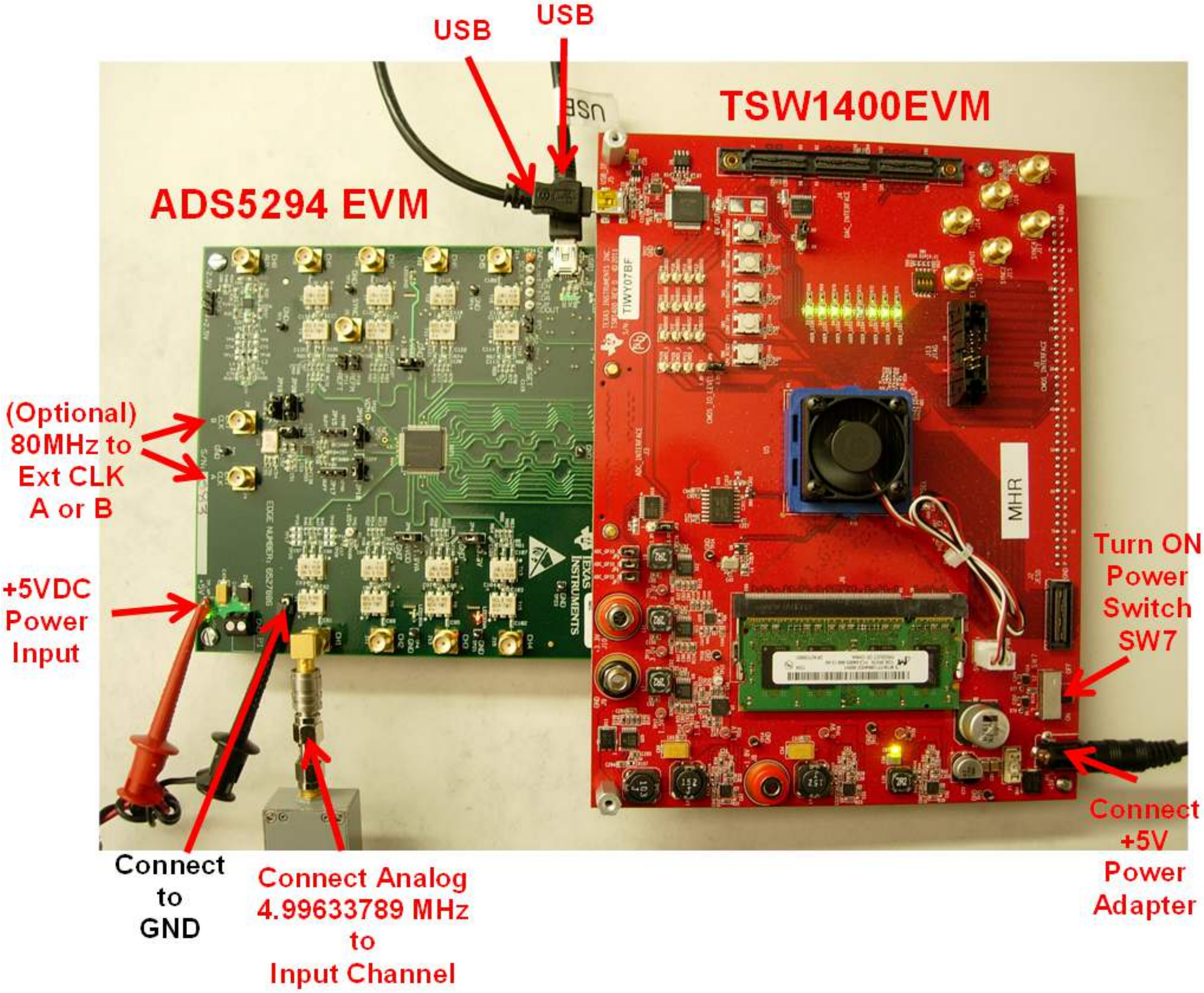
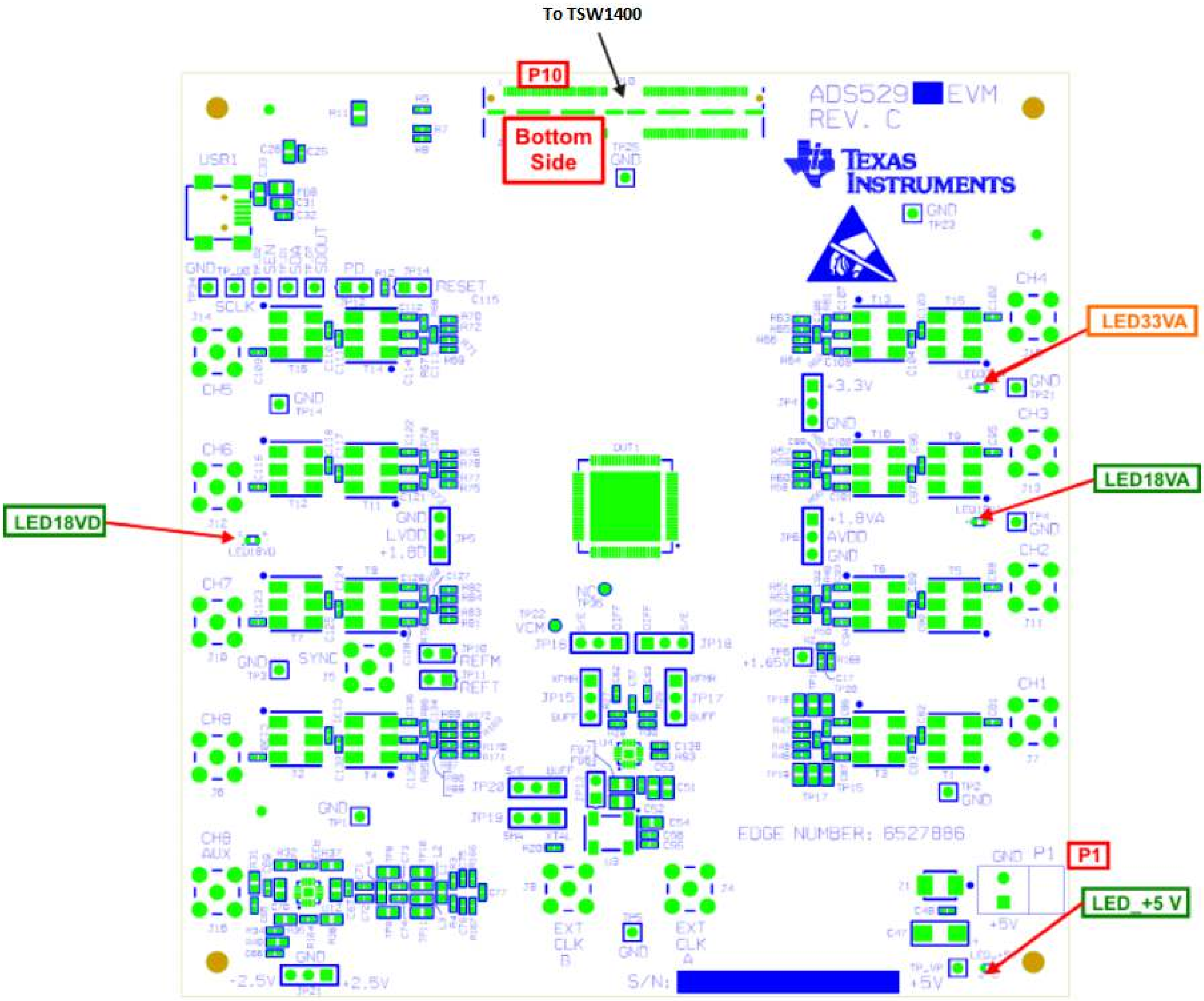


Figure 3. HW Setup With Connection Between TSW1400EVM and ADS5294EVM

5 Power Up ADS5294

After connecting the ADS5294EVM to the TSW1400 using the **P10** connector, +6-V adapter to TSW1400EVM, and +5 V (from the external power supply) to **P1** connector, then power up is complete. Three green LEDs and one orange LED turned on as shown in Figure 4 (also see Figure 13).


To TSW1400

P10

Bottom Side

LED33VA

LED18VA

LED18VD

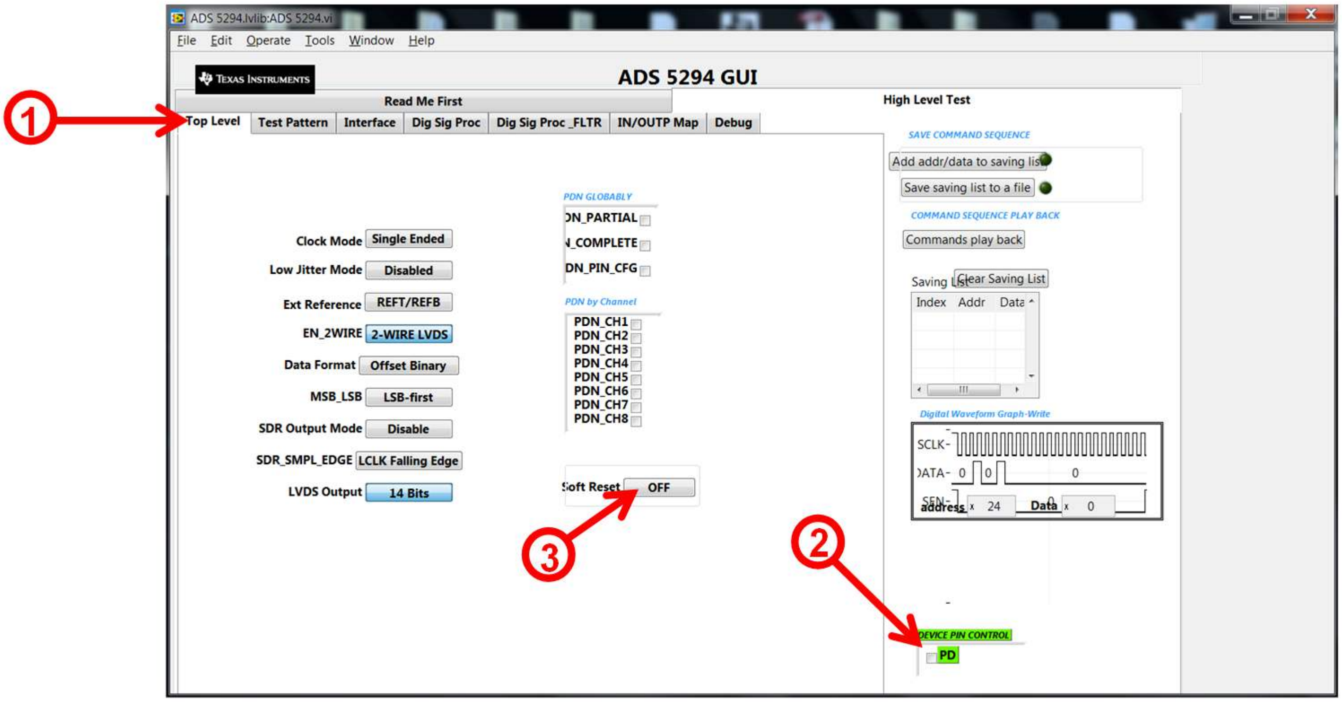
P1

LED_+5 V

Figure 4. Power-Up Indications

6 Launch ADS5294 GUI

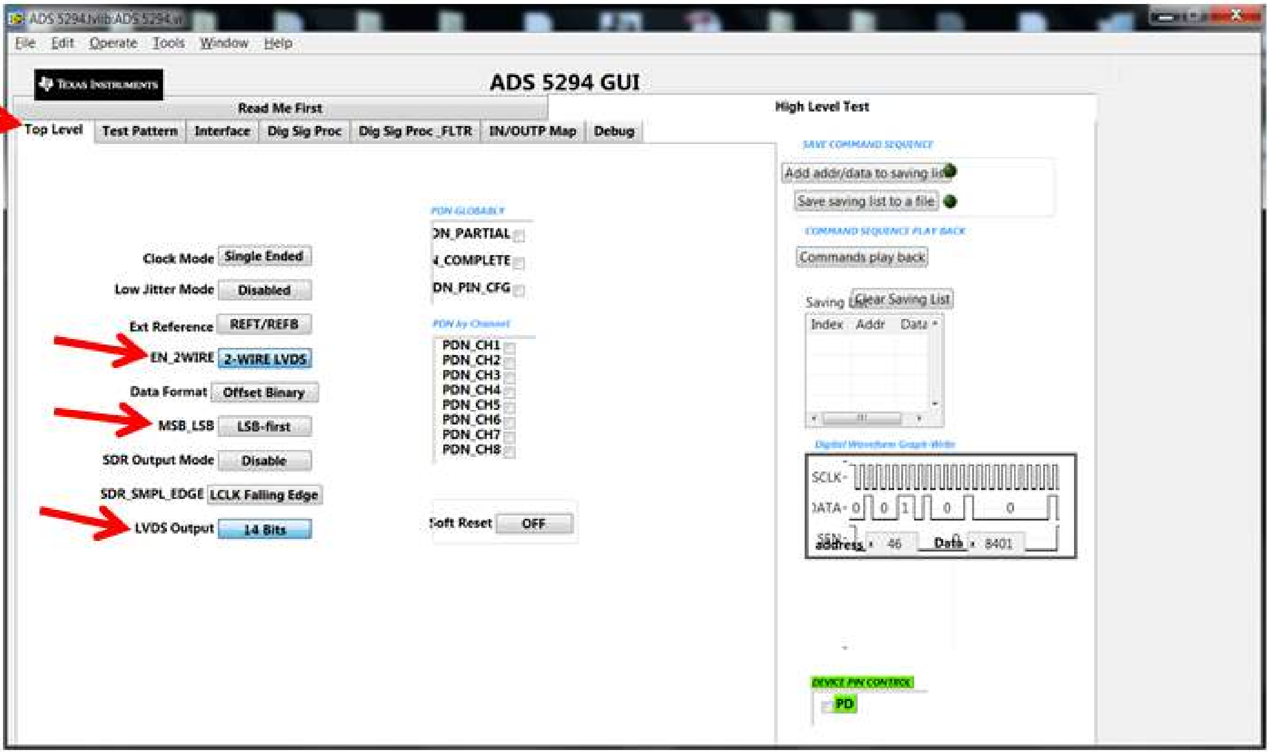
After launching the ADS5294 GUI, the GUI appears as is shown in Figure 5. After the GUI is completely launched, the window appears as is displayed in Figure 5. Select the **Top Level** tab to observe the default condition. The bottom status bar indicates *Ready for new command* and green (highlighted). Click on checkbox **PD**, and select it for power down to ensure proper software link to the hardware by observing change in current reading (approximately 450 mA to 150 mA) of the external +5-V power supply. For the rest of the test, **PD** must be unchecked. Click on **Soft Reset** button to reset device internally.



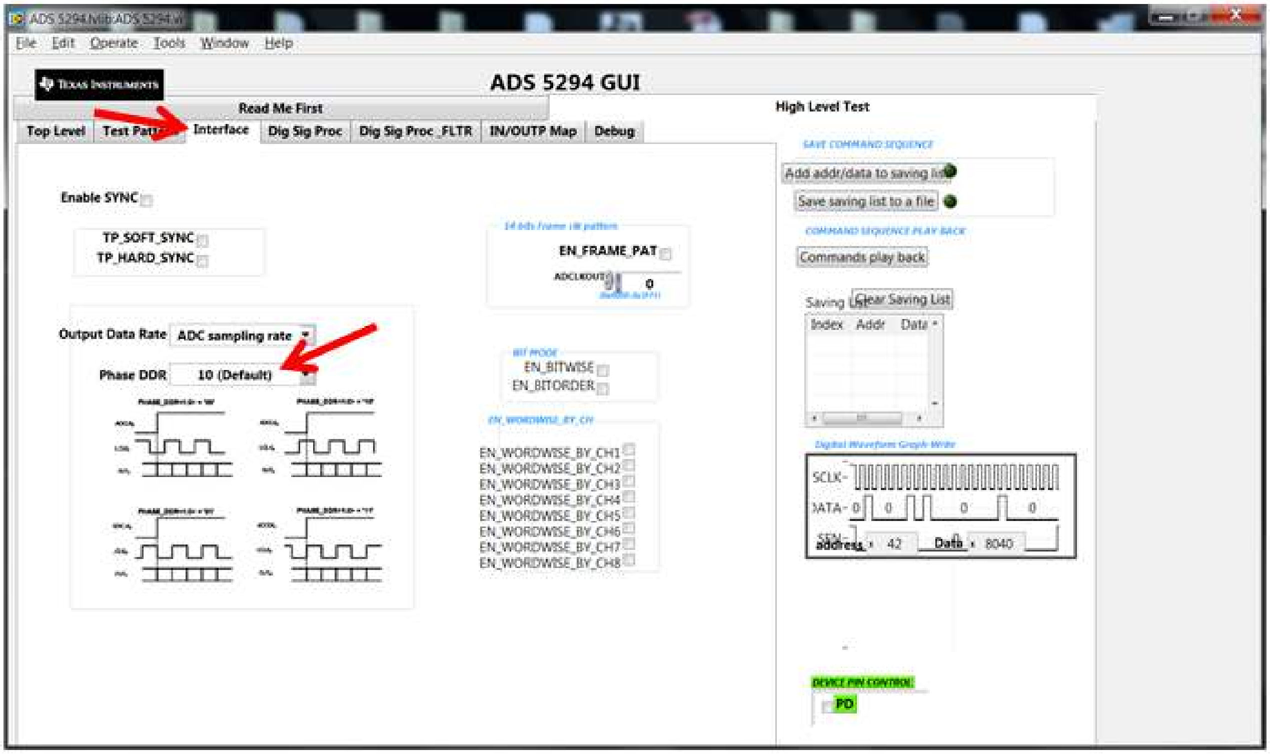
Clock Mode: Single Ended
Low Jitter Mode: Disabled
Ext Reference: REFT/REFB
EN_2WIRE: 2-WIRE LVDS
Data Format: Offset Binary
MSB_LSB: LSB-first
SDR Output Mode: Disable
SDR_SMPL_EDGE: LCLK Falling Edge
LVDS Output: 14 Bits
Soft Reset: OFF

Figure 5. ADS5294 GUI Launch

After GUI launch and verification of software communication with EVM, click on button **EN_2WIRE**. This configures the ADC output interface in **2-WIRE LVDS** mode. Also click button **ADC Bit Resolution** to set ADC in **14 Bits** mode. Ensure that the **MSB_LSB** button status shows **LSB_First**.



Clock Mode: Single Ended
Low Jitter Mode: Disabled
Ext Reference: REFT/REFB
EN_2WIRE: 2-WIRE LVDS
Data Format: Offset Binary
MSB_LSB: LSB-first
SDR Output Mode: Disable
SDR_SMPL_EDGE: LCLK Falling Edge
LVDS Output: 14 Bits
Soft Reset: OFF
Address: 46
Data: 8401

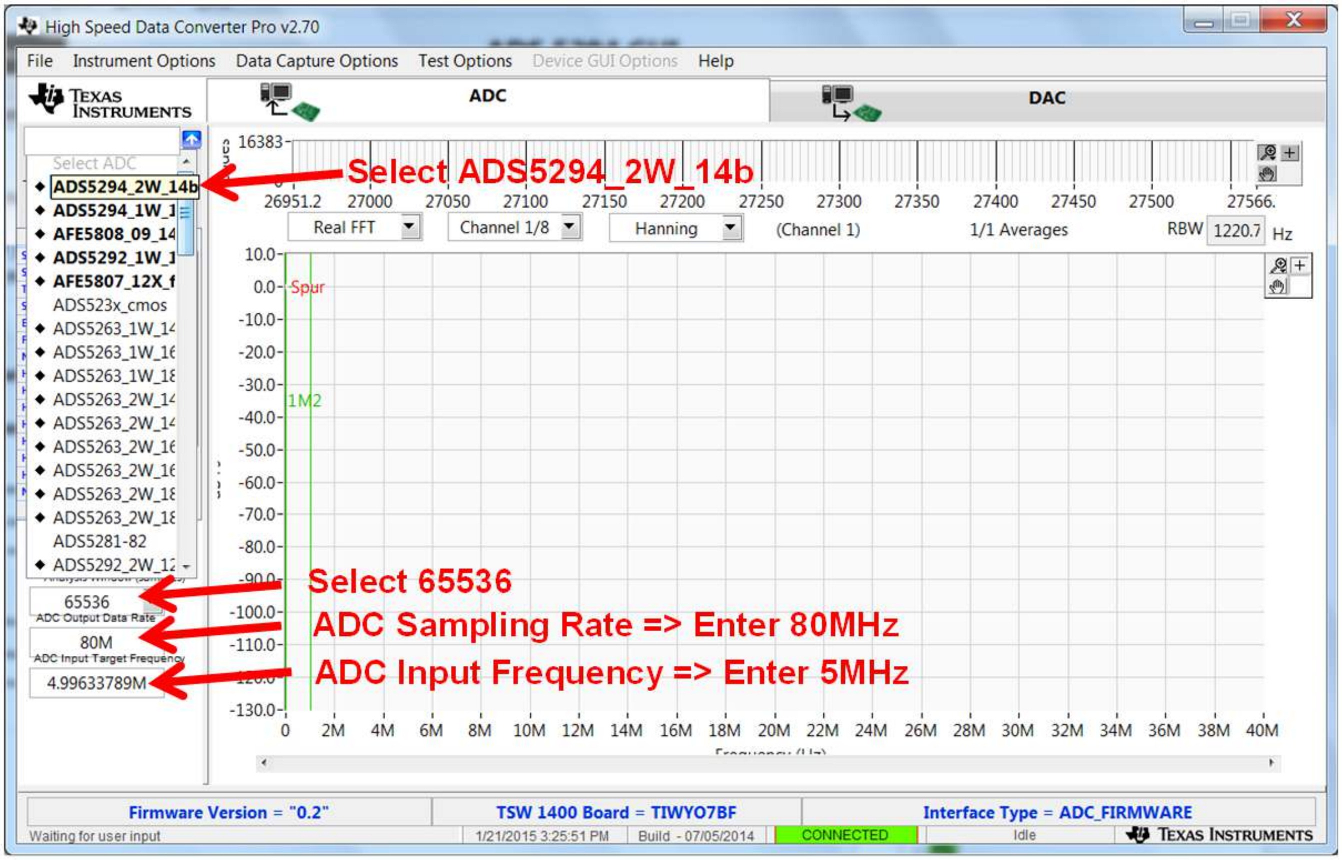


Output Data Rate: ADC sampling rate
Phase DDR: 10 (Default)
Address: 42
Data: 8040

7 Launch TSW1400 GUI

Launch TSW1400 GUI. The **Message** window displays this message to indicate that the setup of the TSW1400EVM and ADS5294EVM is working properly. If a different message or an error message appears, contact TI FAE.

1. Select **ADS5294_2W, 14bits**, from the GUI.
2. **ADC Sampling Rate (Fs)** is fixed at 80 MHz; this is the onboard CMOS clock frequency.
3. **ADC Input Frequency** – enter 5M and the GUI calculates the real coherent frequency (Fc) to 4.99633789M.



Select ADS5294_2W_14b

Select 65536

ADC Sampling Rate => Enter 80MHz

ADC Input Frequency => Enter 5MHz

65536

ADC Output Data Rate: 80M

ADC Input Target Frequency: 4.99633789M

Firmware Version = "0.2"

TSW 1400 Board = TIWYO7BF

Interface Type = ADC_FIRMWARE

Waiting for user input

1/21/2015 3:25:51 PM

Build - 07/05/2014

CONNECTED

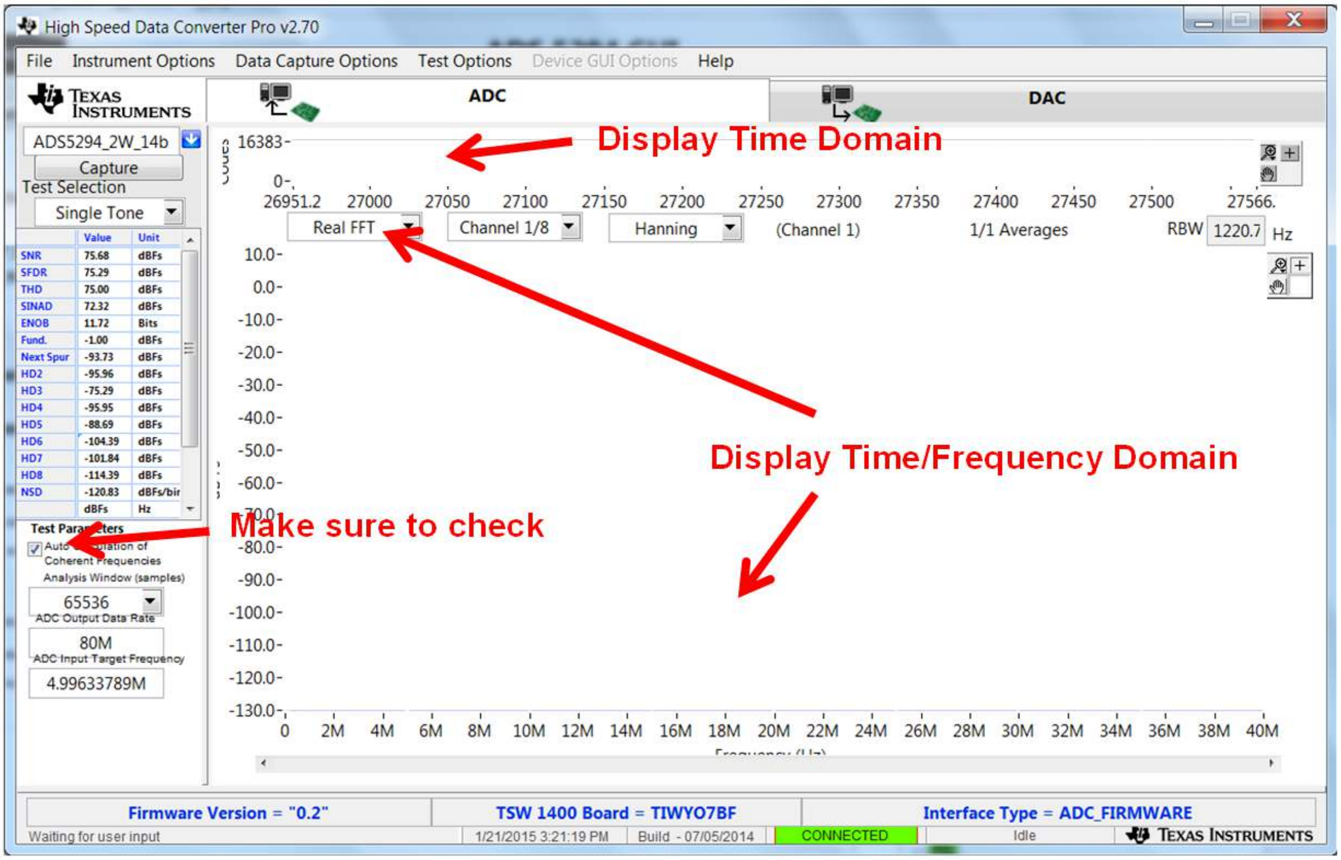
Idle

Figure 6. TSW1400 GUI Launch

8 TEST ADS5294

Step 1: Time Domain

- Select **Time Domain** page from TSW1400 GUI.



Display Time Domain

Display Time/Frequency Domain

Make sure to check

ADS5294_2W_14b

Test Selection: Single Tone

Real FFT | Channel 1/8 | Hanning | (Channel 1) | 1/1 Averages | RBW 1220.7 Hz

	Value	Unit
SNR	75.68	dBFs
SFDR	75.29	dBFs
THD	75.00	dBFs
SINAD	72.32	dBFs
ENOB	11.72	Bits
Fund.	-1.00	dBFs
Next Spur	-93.73	dBFs
HD2	-95.96	dBFs
HD3	-75.29	dBFs
HD4	-95.95	dBFs
HD5	-88.69	dBFs
HD6	-104.39	dBFs
HD7	-101.84	dBFs
HD8	-114.39	dBFs
NSD	-120.83	dBFs/bir
	dBFs	Hz

Test Parameters

☑ Auto Calculation of Coherent Frequencies

Analysis Window (samples): 65536

ADC Output Data Rate: 80M

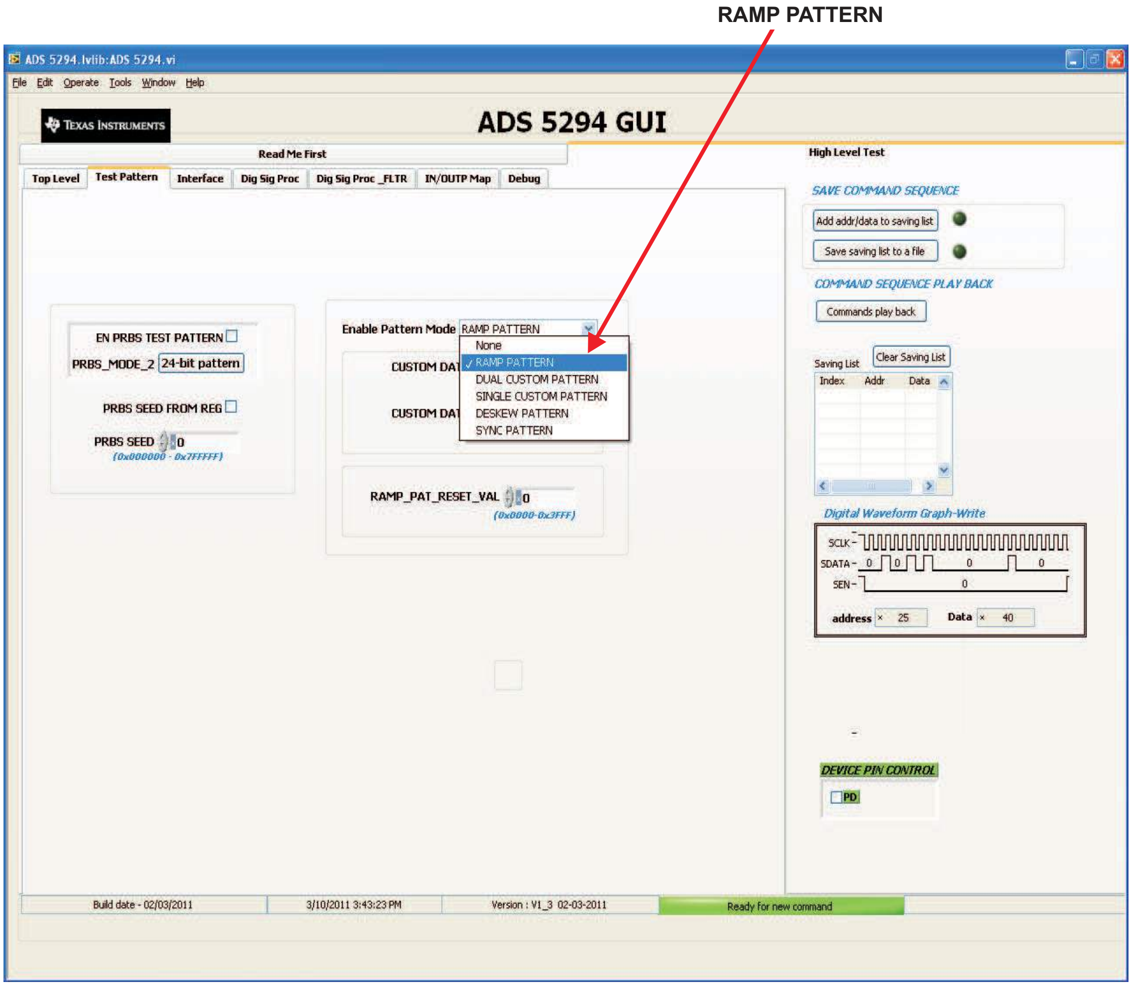
ADC Input Target Frequency: 4.99633789M

Firmware Version = "0.2" | TSW 1400 Board = TIWYO7BF | Interface Type = ADC_FIRMWARE

Waiting for user input | 1/21/2015 3:21:19 PM | Build - 07/05/2014 | CONNECTED | Idle

Figure 7. ADS5294 Time Domain Setup

- From ADS5294 GUI, go to **Test Pattern** page, then select **RAMP PATTERN**.



EN PRBS TEST PATTERN ☐
PRBS_MODE_2 24-bit pattern
PRBS SEED FROM REG ☐
PRBS SEED 0 (0x000000 - 0x7FFFFF)
Enable Pattern Mode RAMP PATTERN
RAMP_PAT_RESET_VAL 0 (0x0000-0x3FFF)
address x 25 Data x 40
Build date - 02/03/2011
3/10/2011 3:43:23 PM
Version : V1_3 02-03-2011
Ready for new command

Figure 8. ADS5294 Test Pattern

- Press Capture button on TSW1400 GUI. You observe a ramping waveform on the TSW1400 GUI display area as shown in Figure 9.
- Repeat for Channel 2...Channel 8.
- **If each channel has the output as shown in the following illustration, you can proceed with the next step; otherwise, contact the TI FAE (Field Application Engineer) to troubleshoot the problem.**
- On the ADS5294 GUI, change Test Pattern to **None** from **RAMP PATTERN** for next step.

ADS5294_2W_14b

	Value	Unit
Min	0.00	Codes
Max	16383.00	Codes
St Dev	4729.69	Codes
Mean	8191.50	Codes
Median	8191.50	Codes
RMS	4729.65	Codes
Peak to Pe	16383.00	Codes
PAR	4.77	dB
	Codes	Samples
M1	5888.00	0.00E+0
M2	9984.00	4.10E+3
Delta	42949632	4.10E+3

Test Parameters

☑ Auto Calculation of Coherent Frequencies

Analysis Window (samples): 65536

ADC Output Data Rate: 80M

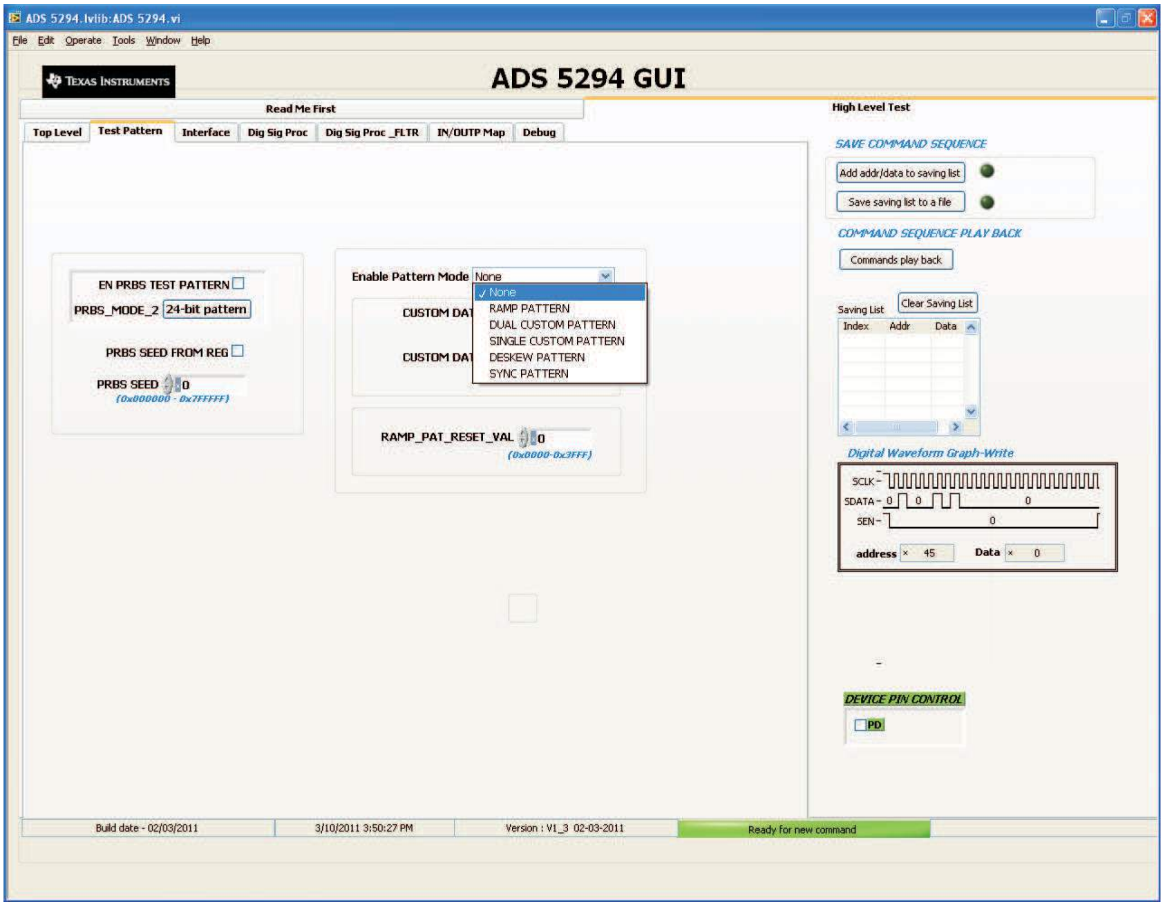
ADC Input Target Frequency: 4.99633789M

Firmware Version = "0.2"

TSW 1400 Board = TIWYO7BF

Interface Type = ADC_FIRMWARE

Figure 9. User Interface: Time Domain Format



EN PRBS TEST PATTERN ☐

PRBS_MODE_2: 24-bit pattern

PRBS SEED FROM REG ☐

PRBS SEED: 0

Enable Pattern Mode: None

RAMP_PAT_RESET_VAL: 0

address: 45

Data: 0

☐ PD

Build date - 02/03/2011

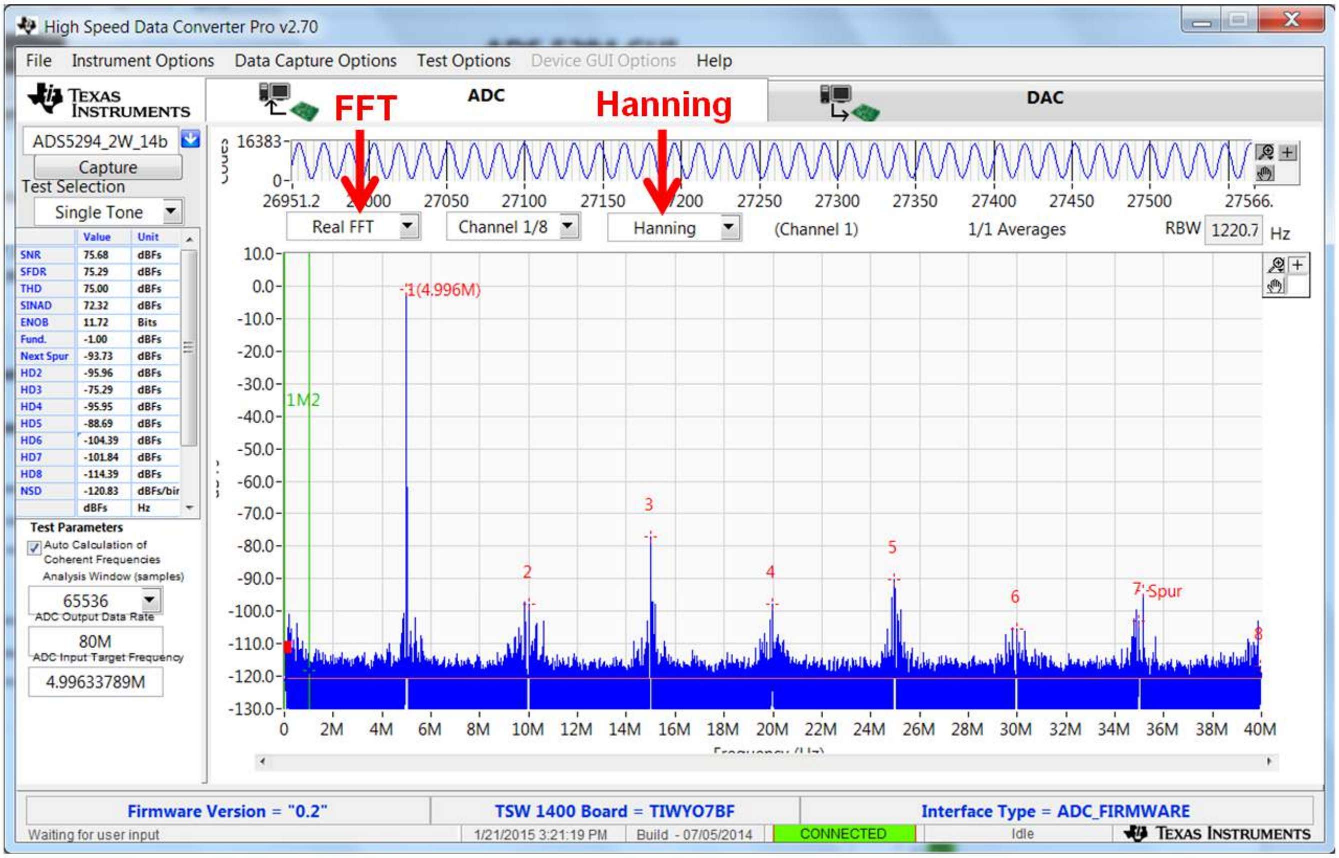
3/10/2011 3:50:27 PM

Version : V1_3 02-03-2011

Ready for new command

8.1 Step 2: Single Tone FFT

- Select **Single Tone FFT** page at TSW1400 GUI.
- Connect Channel 1 of ADS5294EVM to a signal generator through a BP filter. If no **BP filter** is presented, the result is not good.
- Set Amplitude of the signal generator to **10dBm**
- Set Frequency of the signal generator to **4.99633789M** to match the GUI.
- Change window option to **Hanning**. This is due to the fact that input signal and onboard CMOS clock are noncoherent.
- Press Capture button to get the test result.
- Repeat for Channel 2...Channel 8.



ADS5294_2W_14b

Test Selection: Single Tone

	Value	Unit
SNR	75.68	dBFs
SFDR	75.29	dBFs
THD	75.00	dBFs
SINAD	72.32	dBFs
ENOB	11.72	Bits
Fund.	-1.00	dBFs
Next Spur	-93.73	dBFs
HD2	-95.96	dBFs
HD3	-75.29	dBFs
HD4	-95.95	dBFs
HD5	-88.69	dBFs
HD6	-104.39	dBFs
HD7	-101.84	dBFs
HD8	-114.39	dBFs
NSD	-120.83	dBFs/bir
	dBFs	Hz

Test Parameters

☑ Auto Calculation of Coherent Frequencies

Analysis Window (samples): 65536

ADC Output Data Rate: 80M

ADC Input Target Frequency: 4.99633789M

Real FFT | Channel 1/8 | Hanning | (Channel 1) | 1/1 Averages | RBW 1220.7 Hz

Firmware Version = "0.2"

TSW 1400 Board = TIWYO7BF

Interface Type = ADC_FIRMWARE

Waiting for user input

1/21/2015 3:21:19 PM

Build - 07/05/2014

Figure 10. User Interface: Single FFT Format

9 Board Configuration

9.1 Input/Output, Power Supply, and USB

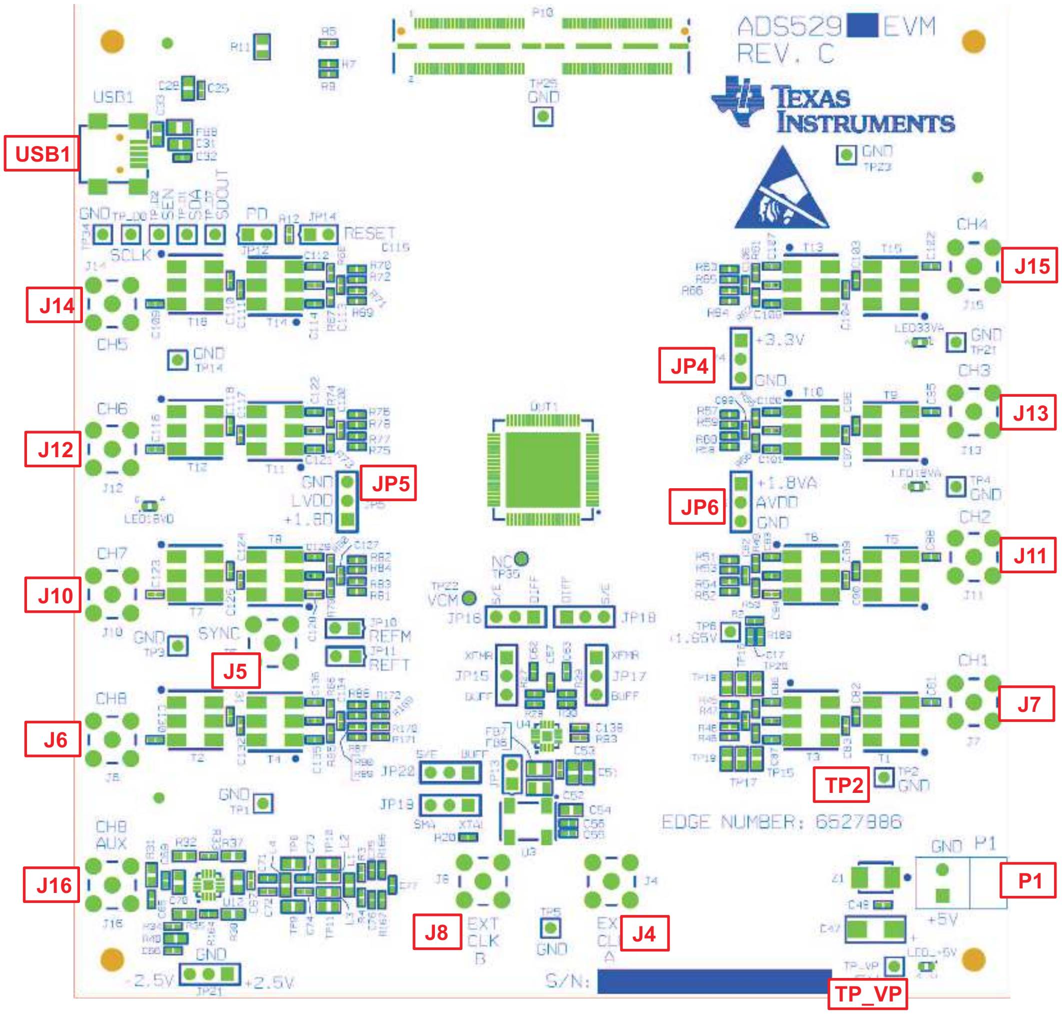


Figure 11. I/O, PWR, and USB Connector

Table 1. Input/Output, Power, and USB

Connector	Description
J6,J7,J10….J15	Analog Input signals for Ch1-Ch8. Connect to a signal generator. A band-pass filter must be applied between the generator and the SMA to get a better result. (See Figure 3)
J16	It is an alternative input for channel 8. Need to install two resistors (R169 and R170) and remove two resistors(R171 and R172) from J6.
P1/TP_VP	P1 is the +5-V power supply connector. TP_VP is the test point for +5-V power supply.
JP4	Onboard 3.3-V Analog enables. Set up as Figure 2 is a must to use onboard 3.3 V
JP5	Onboard 1.8-V Digital enables. Set up as Figure 2 is a must to use onboard 1.8 V
JP6	Onboard 1.8-V Analog enables. Set up as Figure 2 is a must to use onboard 1.8 V
TP1, TP2, TP3, TP4, TP5, TP14, TP21, TP23, TP25, TP34,	Ground test points.
USB1	USB interface connector

Table 2. Channel 8 Configuration

Input Interface Type	Connector	Description
Through Transformer (Default)	J6	In default configuration, R171 and R172 are already populated
Through Amplifier (Not Default)	J16	It is an alternative input for channel 8. Need to install two resistors (R169 and R170) and remove two resistors(R171 and R172) from J6.It uses TI THS4509 single-ended to differential amplifier.

9.2 ADC Clock

Five options are available for the source of the ADC clocks. Refer to Table 3 for details. In Figure 12, ADS5294EVM uses an onboard, single-ended clock as the default option.

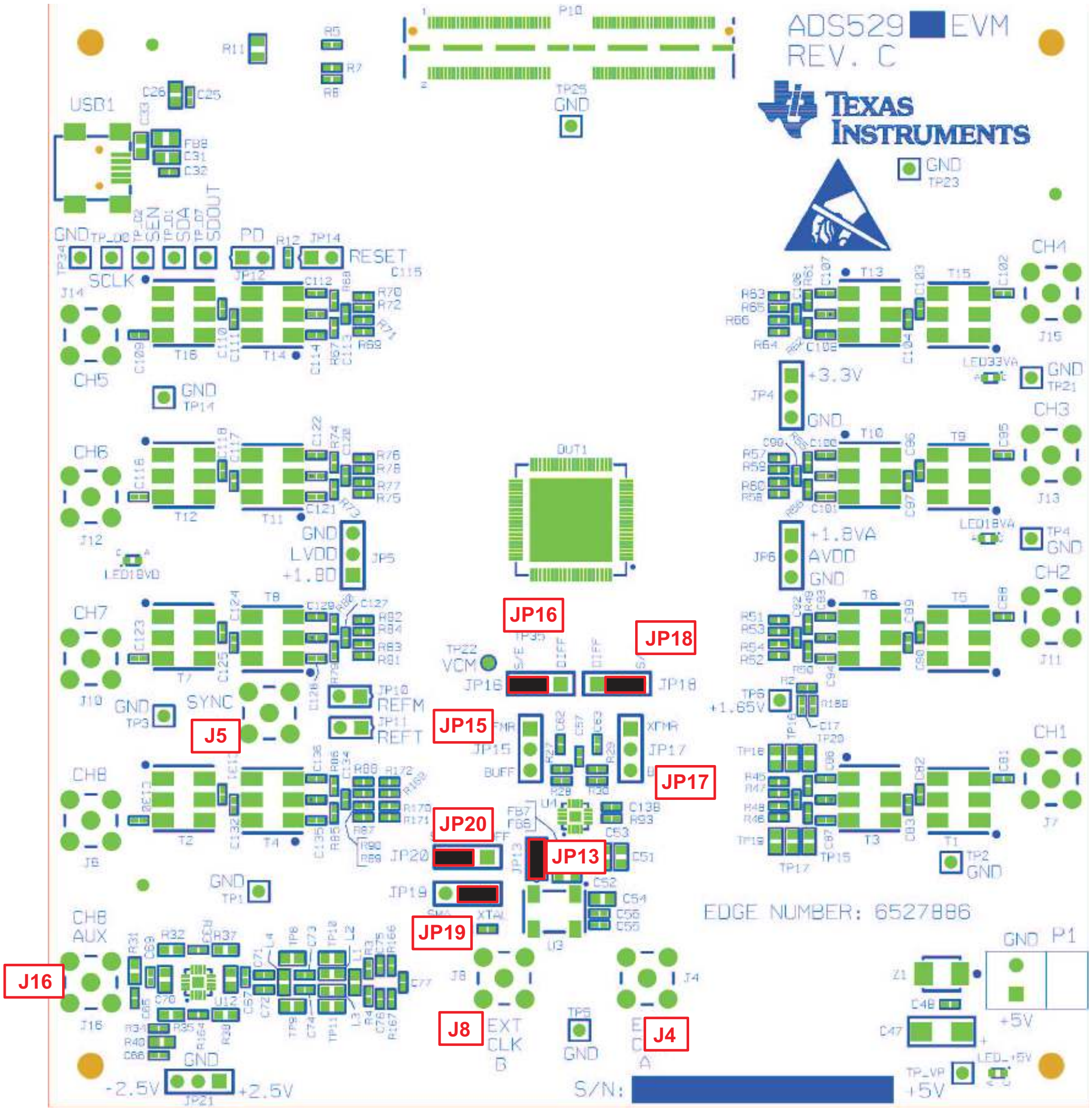


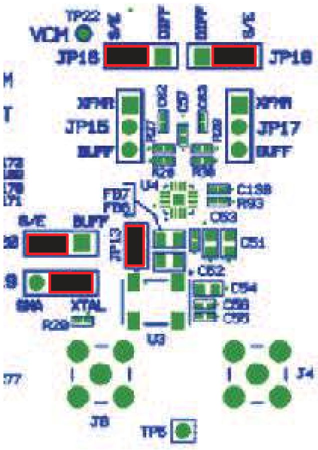
Figure 12. ADS5294EVM Default Clock Jumper Locations

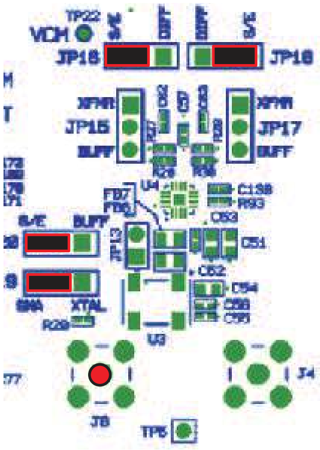
Table 3. ADC Clock Various Mode Jumper Settings

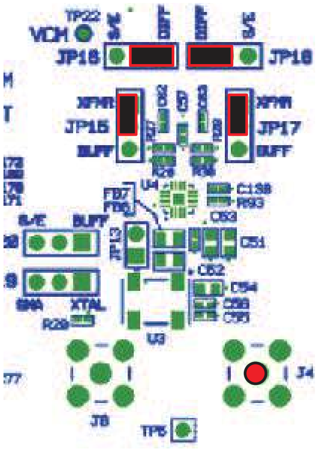
Clock Type		Reference Designator	Jumper Setting	Diagram
Single Ended	Onboard CMOS Oscillator	JP13, JP19, JP20, JP16, JP18	JP13 (1-2), JP20 (2-3), JP19 (1-2), JP16 (2-3), JP18 (2-3)	Dia. 1 (Default Option)
	External CMOS Clock Generator	J8, JP19, JP20, JP16, JP18	JP20 (2-3), JP19 (2-3), JP16 (2-3), JP18 (2-3) and Connect CMOS clock generator output at SMA connector J8.	Dia. 2

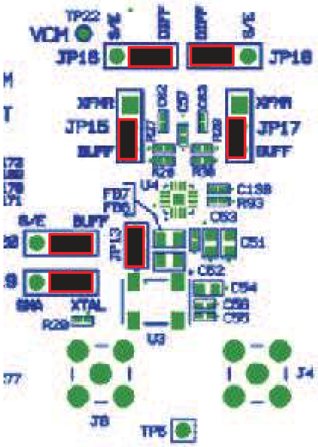
Table 3. ADC Clock Various Mode Jumper Settings (continued)

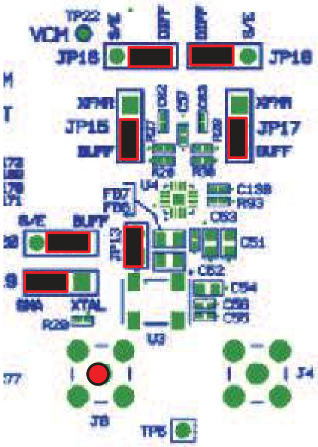
Clock Type		Reference Designator	Jumper Setting	Diagram
Differential Clock Signal	Transformer Based External	JP15, JP17, JP16, JP18, J4	JP15 (1-2), JP16 (1-2),JP17 (1-2), JP18 (1-2), and Connect external Clock source at SMA connector J4	Dia. 3
	Onboard Clock Buffer (CDCLVP1102,U4)	JP13, JP19, JP20, JP15, JP17, JP16, JP18	JP13 (1-2), JP20 (1-2), JP19 (1-2), JP15 (2-3), JP17 (2-3), JP16 (1-2), JP18 (1-2). This configures the onboard CMOS oscillator as clock input to buffer.	Dia. 4
		J8, JP19, JP20, JP15, JP17, JP16, JP18	JP19 (2-3), JP20 (1-2), JP15 (2-3), JP17 (2-3), JP16 (1-2), JP18 (1-2) and Connect External CMOS generator output at SMA connector J8. This configures the external CMOS source as clock input to buffer.	Dia. 5


Dia.1


Dia.2


Dia.3


Dia.4


Dia.5

9.3 Light-Emitting Diodes

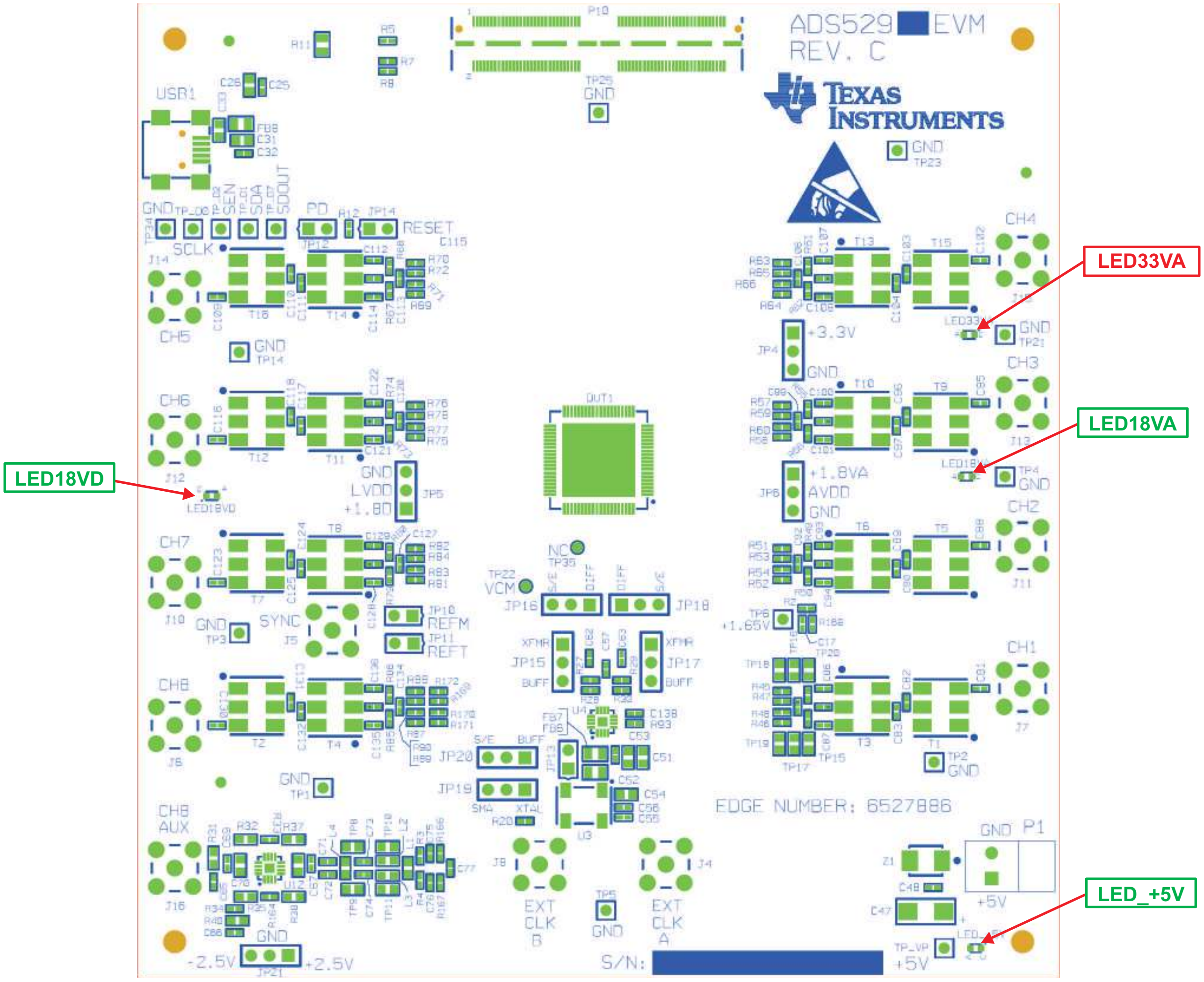


Figure 13. ADS5294EVM LED Location

Table 4. LED Indicators

Reference Designator	Power Supply	Color
LED_+5V	+5 V	Green
LED1.8VA	+1.8 VA	Green
LED1.8VD	+1.8 VD	Green
LED3.3VA	+3.3 VA	Orange

9.4 Miscellaneous Test Points

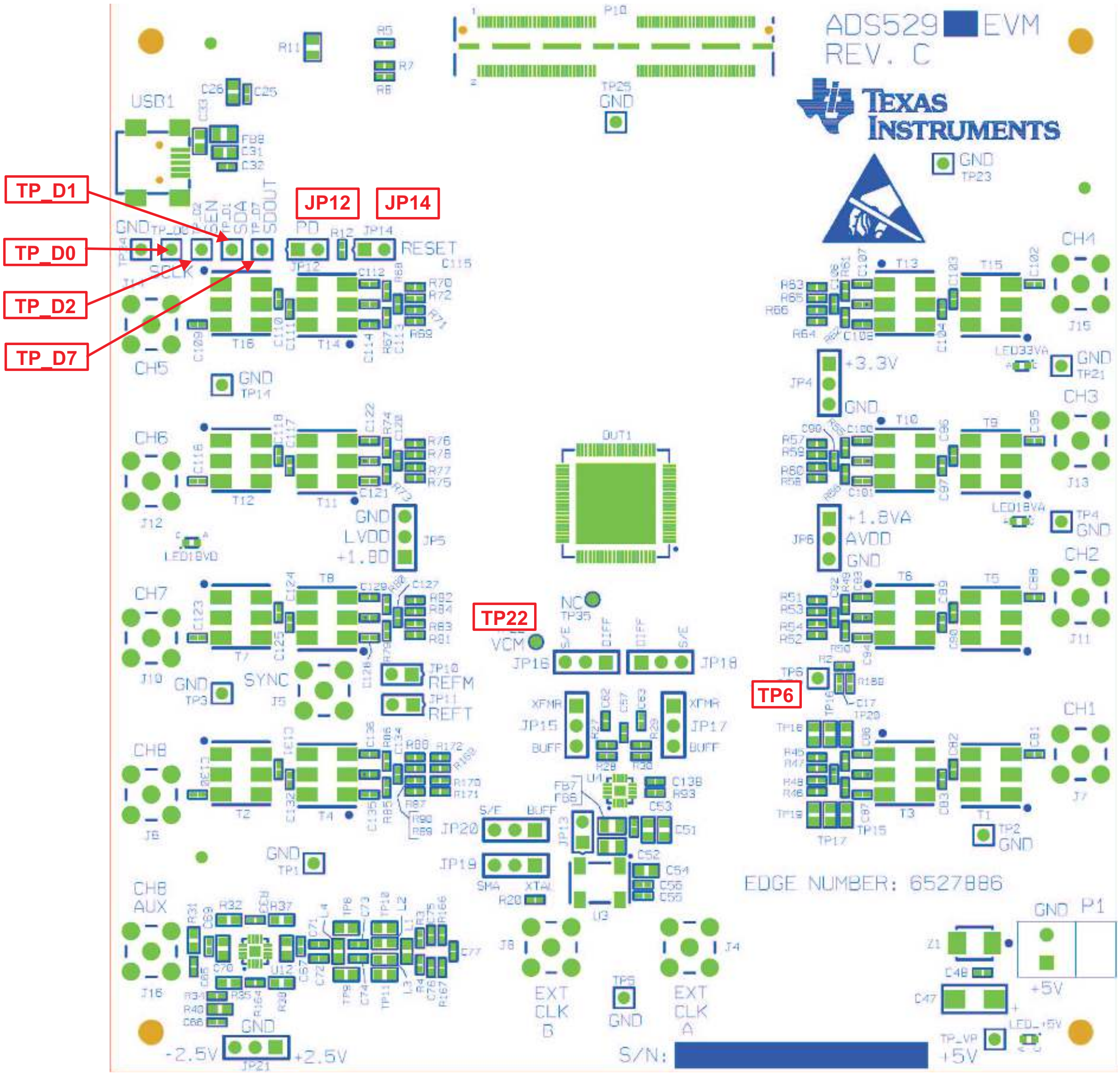


Figure 14. ADS5294EVM Test Point Locations

Table 5. Miscellaneous Test Points

Reference Designator	Description
TP22	VCM: Common-mode output pin, 0.95-V output
TP6	CDC_VTH: Fixed voltage level (1.65 V)
TP_D0	SCLK: Serial clock input
TP_D1	SDA: Serial data input
TP_D2	SEN: Serial enable chip select
TP_D7	SDOUT: Serial data output
JP14	RESET: Install to reset the device (DUT1) manually
JP12	PD: Install to power down the device (DUT1) manually

10 EVM Schematics

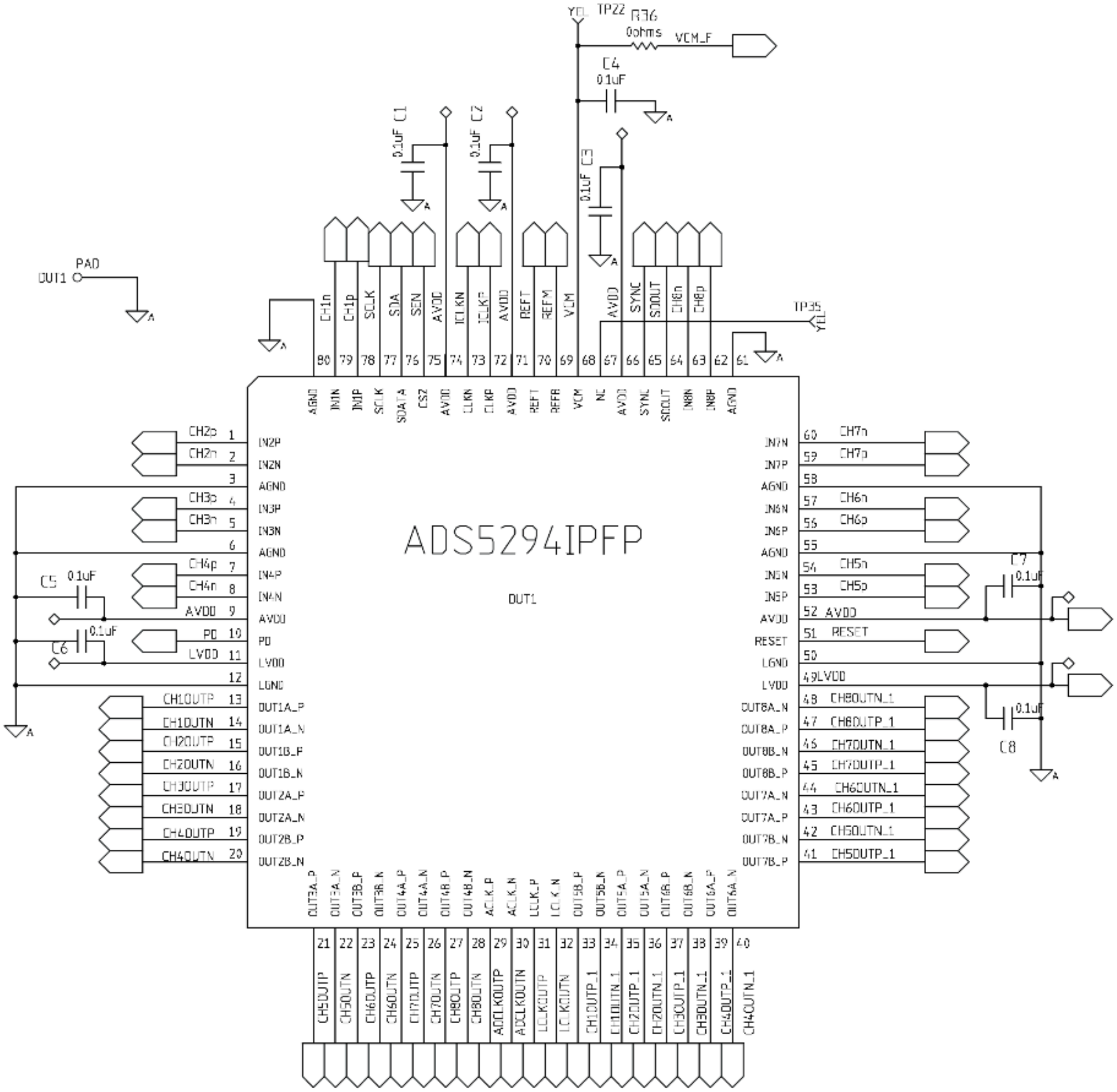


Figure 15. Schematic, Sheet 1 of 9

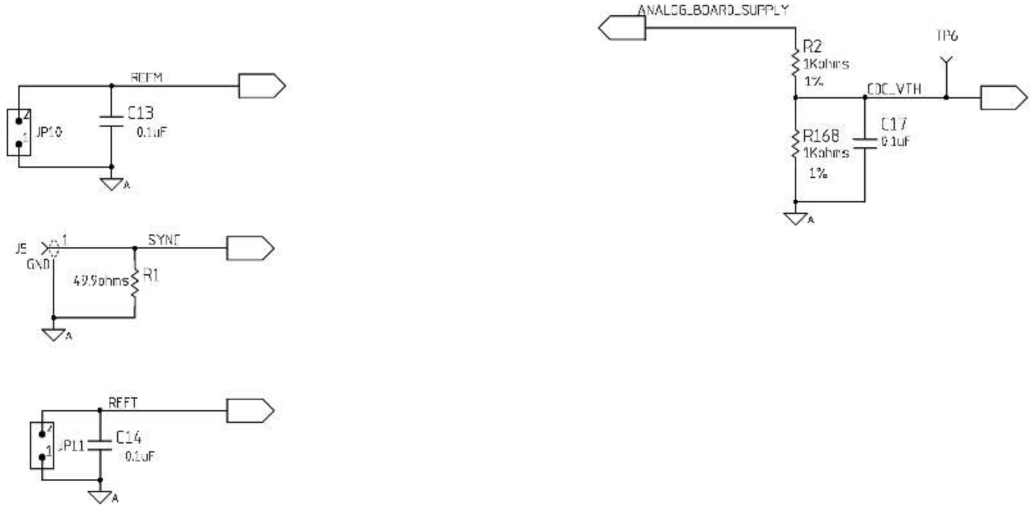


Figure 16. Schematic, Sheet 2 of 9

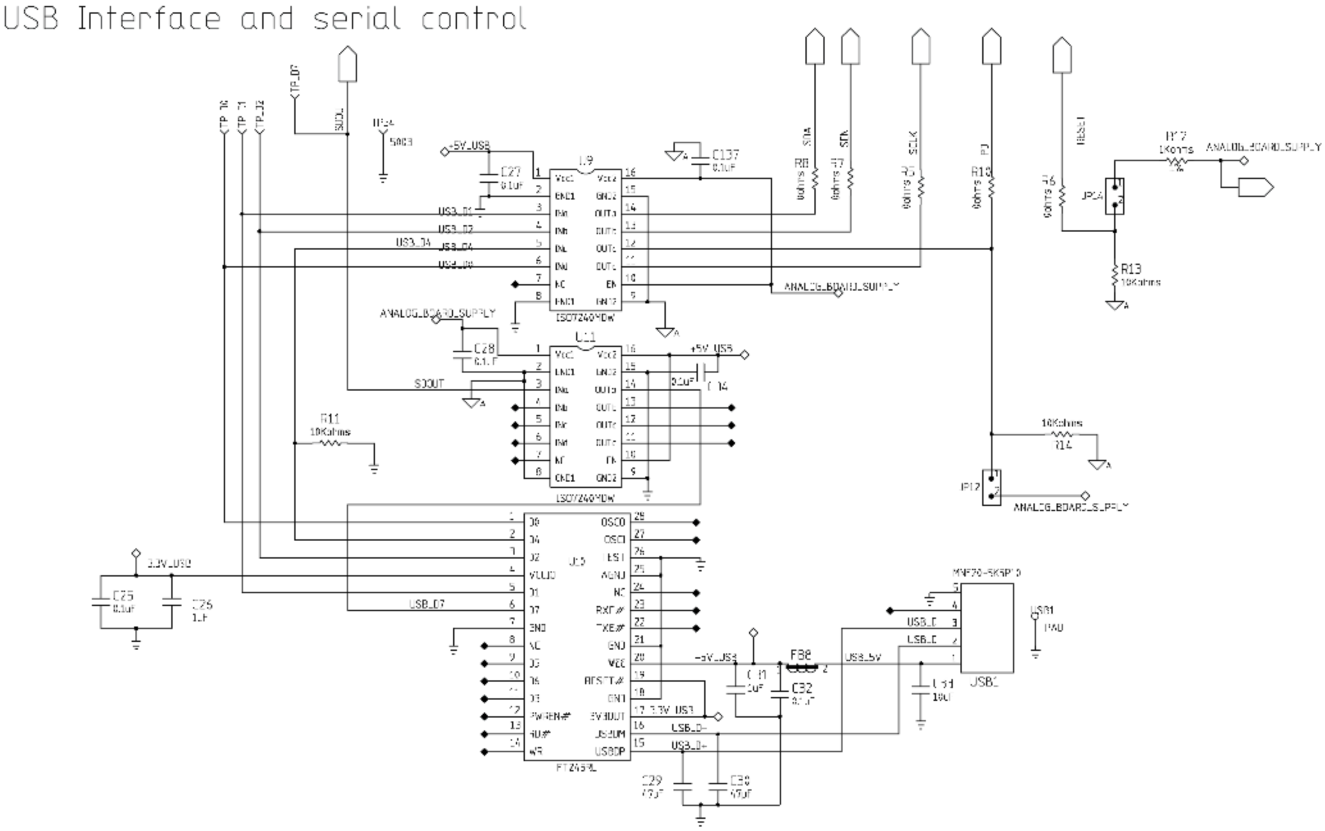


Figure 17. Schematic, Sheet 3 of 9

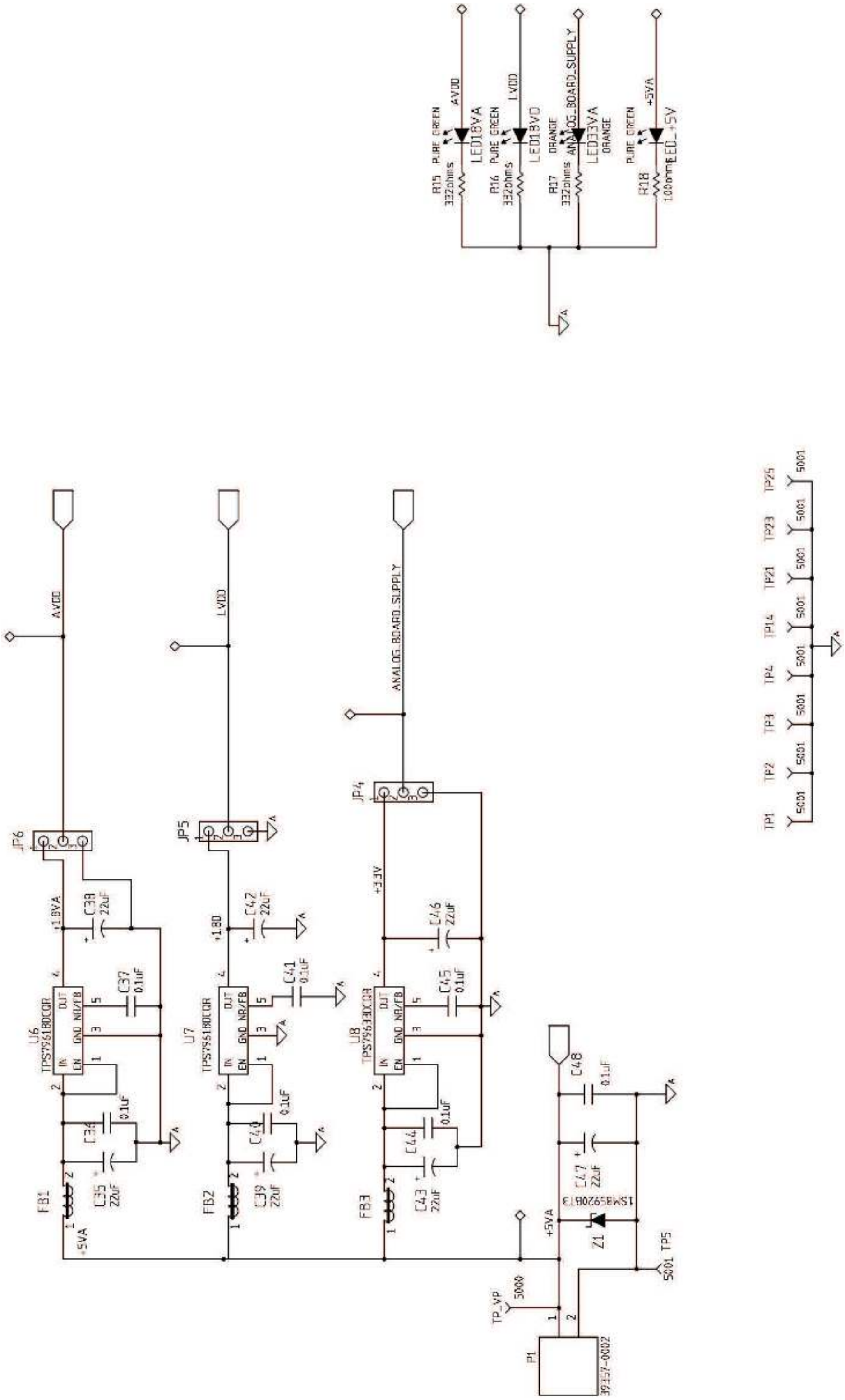


Figure 18. Schematic, Sheet 4 of 9

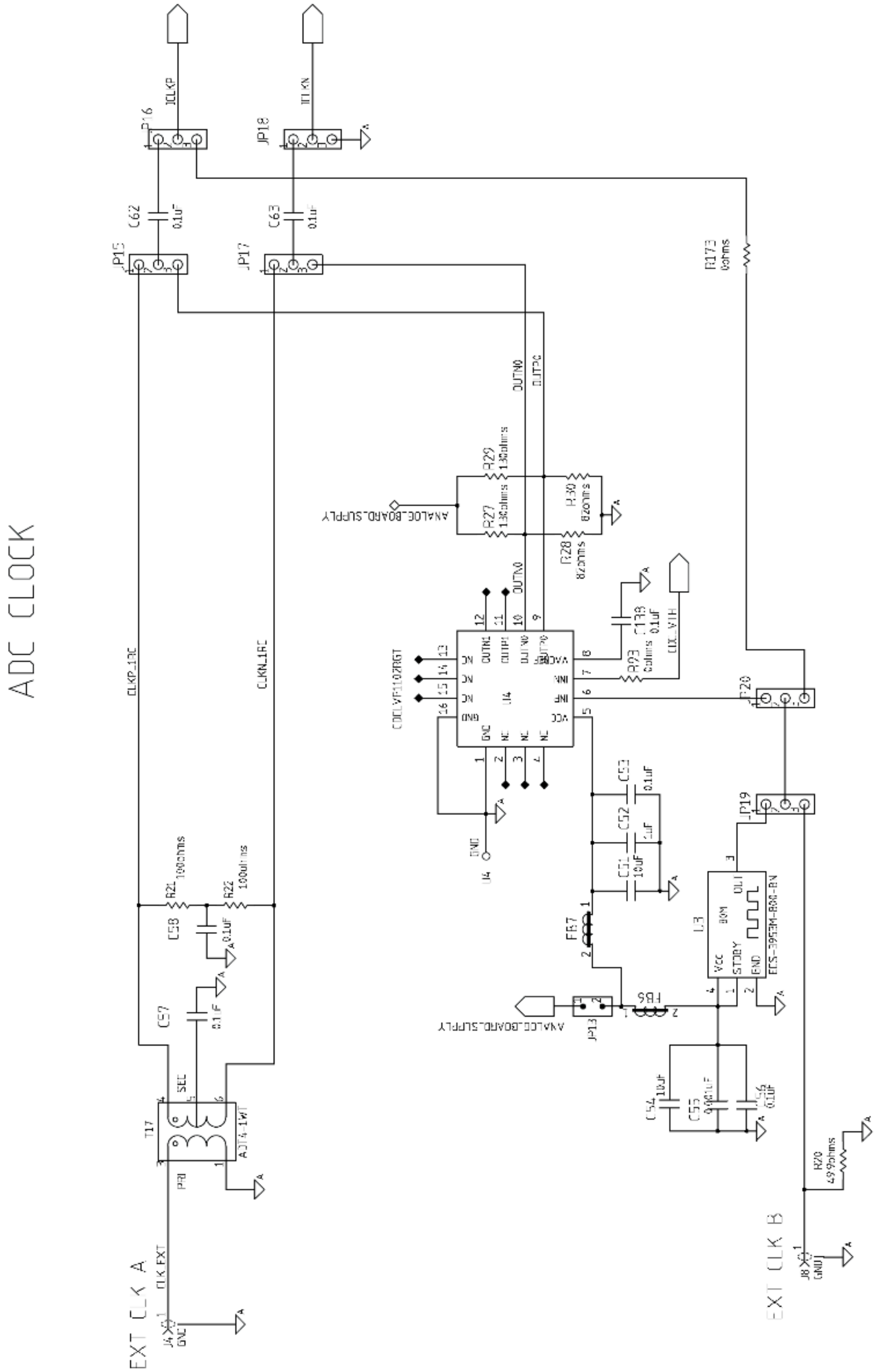


Figure 19. Schematic, Sheet 5 of 9

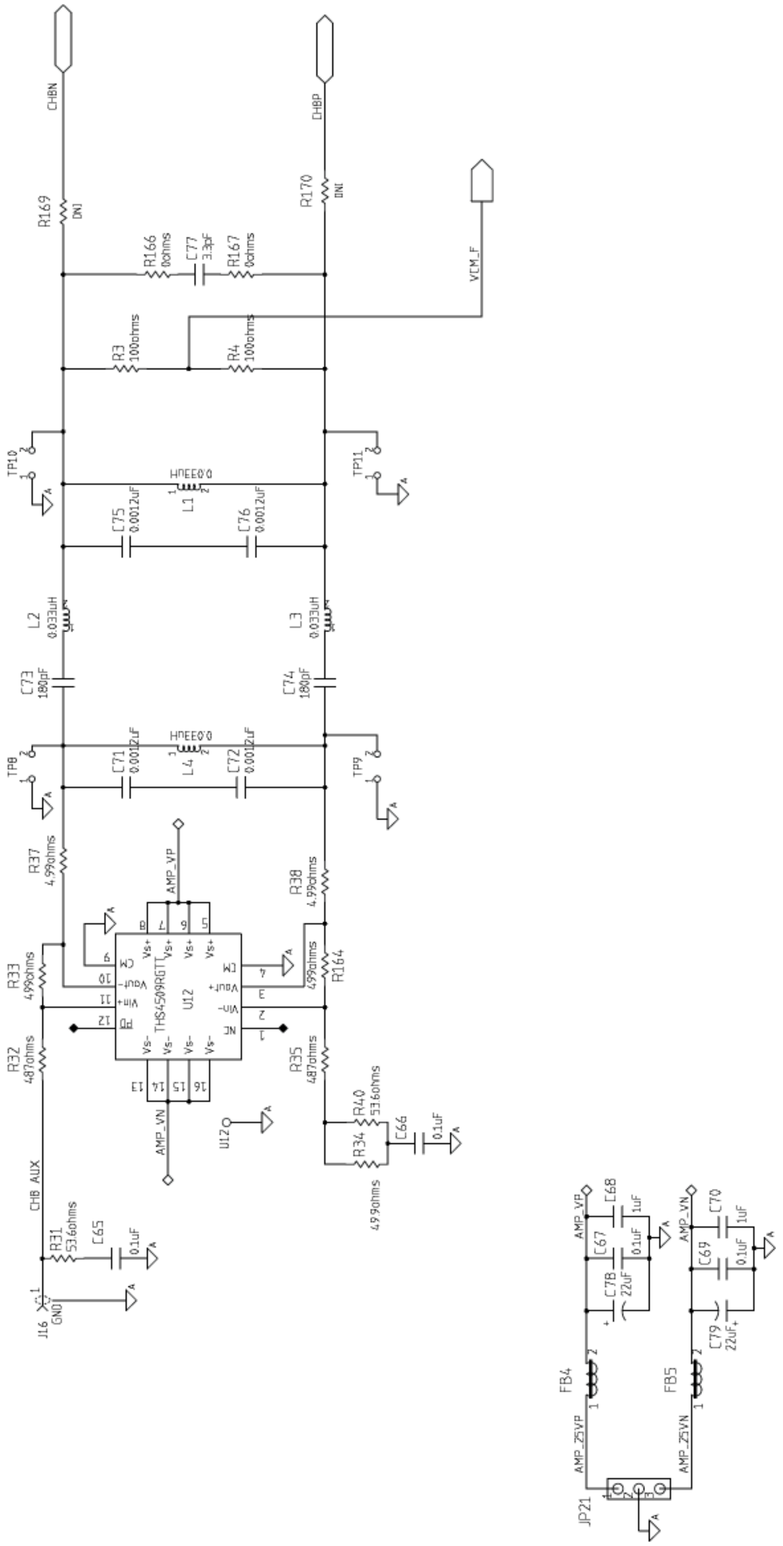


Figure 20. Schematic, Sheet 6 of 9

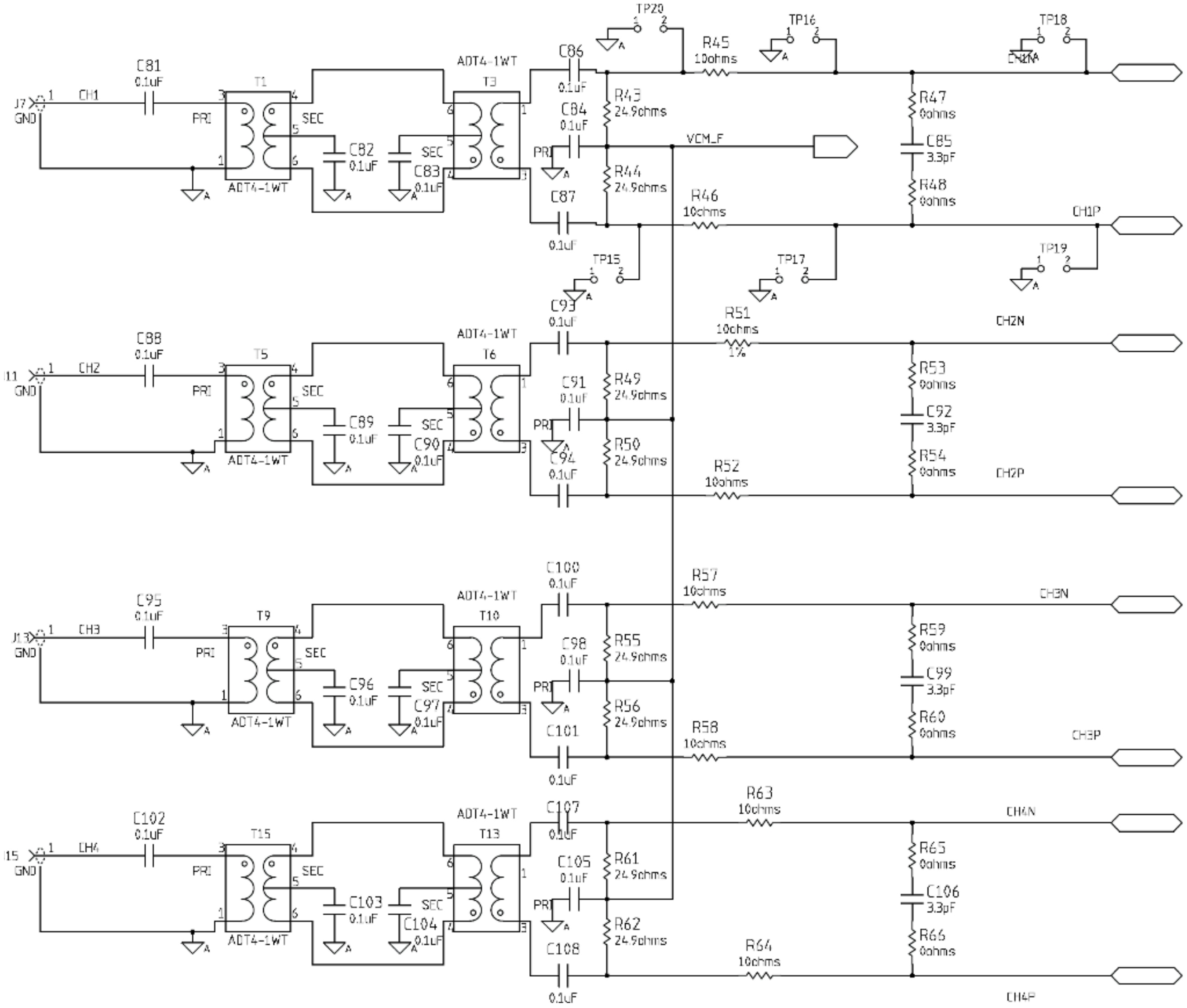


Figure 21. Schematic, Sheet 7 of 9

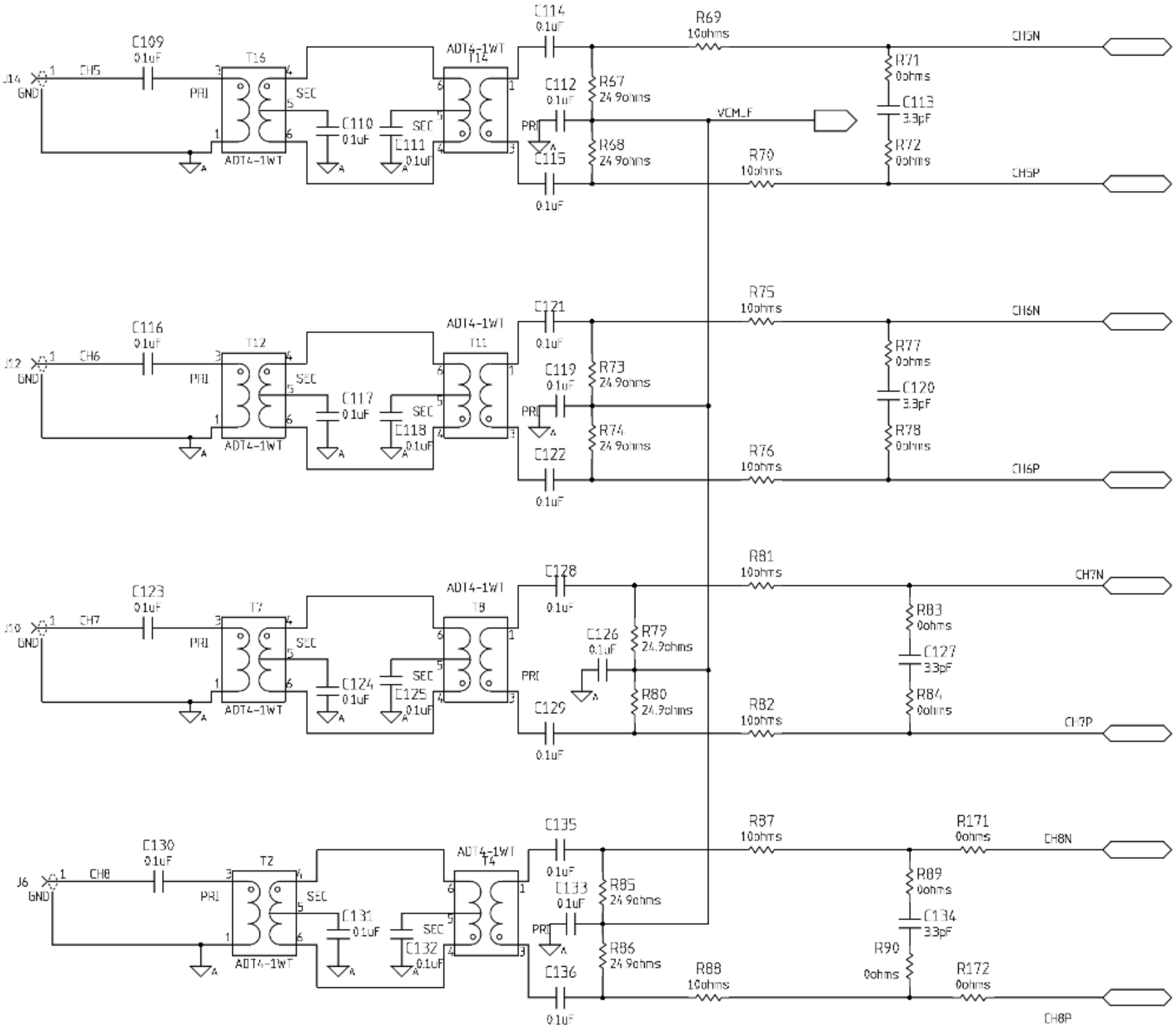


Figure 22. Schematic, Sheet 8 of 9

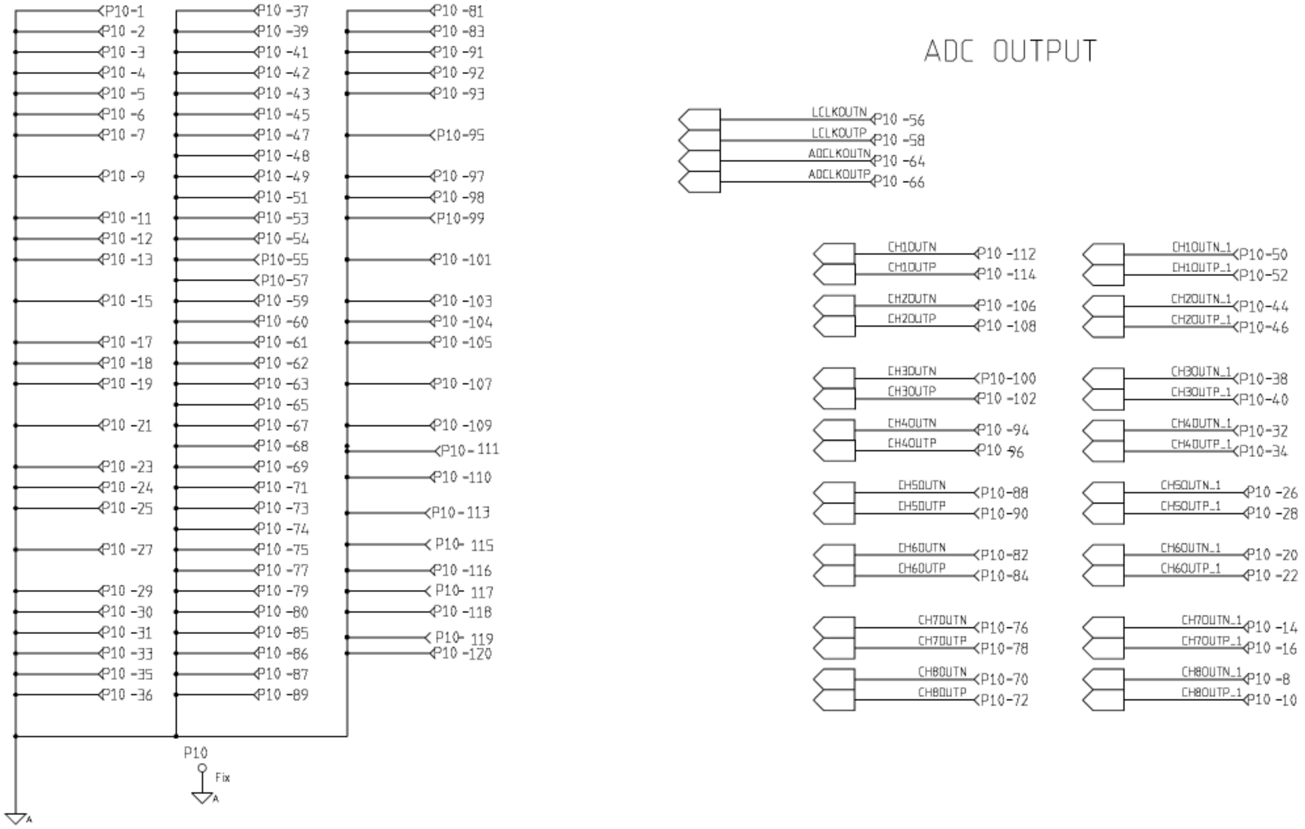


Figure 23. Schematic, Sheet 9 of 9

11 ADS5294EVM Bill of Materials

Bill of Materials

QTY	MFR P/N	Description	Value	MFR	REF DES
1	ADS5294IPFP	14-Bit 8-Channel ADC	ADS5294	Texas Instruments	DUT1
17	ADT4-1WT+	RF TRANSFORMER WIDEBAND, 2-775 MHz, 50 Ω	ADT4-1WT+	Mini-Circuits	T1–T17
1	CDCLVP1102RGT	TWO LVPECL OUTPUT CLOCK BUFFER	CDCLVP1102	Texas Instruments	U4
2	CRCW06034R99FKEA	RES 4.99 Ω, 1/10 W, 1% 0603 SMD	4.99 Ω	Vishay/Dale	R37, R38
16	CRCW040210R0FKED	RES 10 Ω, 1/16,W, 1% 0402 SMD	10 Ω	Vishay/Dale	R45, R46, R51, R52, R57, R58, R63, R64, R69, R70, R75, R76, R81, R82, R87, R88
1	CRCW040249R9FKED	RES 49.9 Ω, 1/16,W, 1% 0402 SMD	49.9 Ω	Vishay/Dale	R34
2	CRCW060353R6FKEA	RES 53.6 Ω 1/10W 1% 0603 SMD	53.6 Ω	Vishay/Dale	R31, R40
1	CRCW06030000Z0EA	RES 0 Ω 1/10W 0603 SMD	0 Ω	Vishay/Dale	R36
2	CRCW0603487RFKEA	RES 487 Ω 1/10W 1% 0603 SMD	487 Ω	Vishay/Dale	R32, R35
4	CRCW0402100RFKED	RES 100 Ω 1/16W 1% 0402 SMD	100 Ω	Vishay/Dale	R3, R4, R21, R22
3	CRCW04021K00FKED	RES 1K Ω 1/16W 1% 0402 SMD	1 kΩ	Vishay/Dale	R2, R12, R168
2	CRCW0402499RFKED	RES 499 Ω 1/16W 1% 0402 SMD	499 Ω	Vishay/Dale	R33, R164
3	CRCW080510K0FKEA	RES 10K Ω 1/8W 1% 0805 SMD	10K Ω	Vishay/Dale	R11, R13, R14
7	C0402C104K8PACTU	CAP 0.10UF 10V CERAMIC X5R 0402	0.1 µF	Kemet	C36, C37, C40, C41, C44, C45, C48
1	ECJ-0EB1H102K	CAPACITOR, SMT, 0402, CER, 1000pF, 50V, 10%, X7R	1000 pF	Panasonic	C55
4	ECJ-0EB1H122K	CAPACITOR, SMT, 0402, CER, 1200pF, 50V, 10%, X7R	1200 pF	Panasonic	C71, C72, C75, C76
2	ECJ-0EB1E181K	CAP 180PF 25V CERAMIC X7R 0402	180 pF	Panasonic	C73, C74
2	ECJ-0EC1H390J	CAP 39PF 50V CERAMIC 0402 SMD	39 PF	Panasonic	C29, C30
5	ECJ-1V41E105M	CAP 1UF 25V CERAMIC 0603 X5S	1 µF	Panasonic - ECG	C26, C31, C52, C68, C70
1	ECS-3953M-800-BN	OSC, SMT, 3.3V, 50ppm, -40~85°C, 5nS, 80.000 MHz	OSC 80 MHz	ECS Inc	U3
4	ELJ-RE33NGFA	INDUCTOR 33NH 2% 0603 SMD	33NH	Panasonic	L1–L4
2	ERJ-2GEJ131	RESISTOR, SMT, 0402, THICK FILM, 5%, 1/16W, 130	130 Ω	Panasonic	R27, R29
2	ERJ-2GEJ820	RESISTOR, SMT, 0402, THICK FILM, 5%, 1/16W, 82	82 Ω	Panasonic	R28, R30
27	ERJ-2GE0R00X	RESISTOR/JUMPER, SMT, 0402, 0 Ω, 5%, 1/16W	0 Ω	Panasonic	R5–R8, R10, R47, R48, R53, R54, R59, R60, R65, R66, R71, R72, R77, R78, R83, R84, R89, R90, R93, R166, R167, R171–R173
16	ERJ-2RKF24R9X	RESISTOR, SMT, 0402, 24.9 Ω, 1%, 1/16W	24.9 Ω	Panasonic	R43, R44, R49, R50, R55, R56, R61, R62, R67, R68, R73, R74, R79, R80, R85, R86
2	ERJ-2RKF49R9X	RESISTOR, SMT, 0402, 49.9 Ω, 1%, 1/16W	49.9 Ω	Panasonic	R1, R20
3	ERJ-2RKF1000X	RESISTOR, SMT, 0402, 100 Ω, 1%, 1/10W	100 Ω	Panasonic	R15, R16, R18
1	ERJ-2RKF3320X	RESISTOR, SMT, 0402, 332 Ω, 1%, 1/16W	332 Ω	Panasonic	R17
1	FT245RL	USB FIFO IC INCORPORATE FTDICHIP-ID SECURITY DONGLE	USB	FTDI	U10
9	GRM1555C1H3R3CZ01D	CAP CER 3.3PF 50V C0G 0402	3.3 pF	Murata	C77, C85, C92, C99, C106, C113, C120, C127, C134
8	HI0805R800R-10	FERRITE CHIP POWER 80 Ω SMD	FERRITE	Laird-Signal Integrity Products	FB1–FB8
2	ISO7240MDW	QUAD DIGITAL ISOLATORS	IC DGTL ISOL	Texas Instruments	U9, U11
3	JMK107BJ106MA-T	CAPACITOR, SMT, 0603, CERAMIC, 10µF, 6.3V, 20%, X5R	10 µF	Taiyo Yuden	C33, C51, C54
10	JUMPER-0603(UN)	UNINSTALLED JUMPER, SMT0603	DNI		TP8–TP11, TP15–TP20

Bill of Materials (continued)

QTY	MFR P/N	Description	Value	MFR	REF DES
3	LNJ308G8PRA	LED, SMT, 0603, PURE GREEN, 2.03V	LED	Panasonic	LED18VA, LED18VD, LED_+5V
1	LNJ808R8ERA	LED, SMT, 0603, ORANGE, 1.8V	LED	Panasonic	LED33VA
1	897-43-005-00-100001	CONN RECEPT MINI-USB TYPE B SMT	USB Mini B	Mill-Max	USB1
1	QTH-060-01-L-D-A	HEADER, SMT, 120P, 0.5mm, FEM, 2BANK, RECEPTACLE, 168/198H	CONN	Samtec Inc	P10
2	TEST POINT YELLOW	NOT INSTALLED	DNI		TP22, TP35
1	THS4509QRGTRQ1	WIDEBAND, LOW NOISE, LOW DISTORTION FULLY DIFF AMP, 1900 MHz	IC OPAMP	Texas Instruments	U12
9	TPSC226K016R0375	10%, 16V, 22µF	22 µF	AVX	C35, C38, C39, C4, C43, C46, C47, C78, C79
2	TPS79618DCQR	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR, 1.8V	LDO REG	Texas Instruments	U6, U7
1	TPS79633DCQR	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR	LDO REG	Texas Instruments	U8
1	1SMB5921BT3G	DIODE ZENER 6.8V 3W SMB	DIODE Zener	ON Semiconductor	Z1
5	9-146285-0-02	CONN HEADR BRKWAY 0.100 02POS STR	CONN Header	TE Connectivity	JP10–JP14
10	9-146285-0-03	CONN HEADR BRKWAY 0.100 03POS STR	CONN Header	TE Connectivity	JP4–JP6, JP15–JP21
12	901-144-8	SMA COAX STRAIGHT PCB CURRENT P/N IS 901-144-8RFX	SMA	Amphenol	J4–J8, J10–J16
76	0402YD104KAT2A	CAP CERM 0.1µF 10% 16V X5R 0402	0.1 µF	AVX	C1–C8, C13 C14, C17, C25, C27, C28, C32, C34, C53, C56–C58, C6, C63, C65–C67, C69, C81–C84, C86–C91, C93–C98, C100–C105, C107–C112, C114–C119, 121–C126, C128–C133, C135–C138
1	5000	TESTPOINT, THU, MINIATURE, 0.1LS, 120TL, RED	Test Point,Red	Keystone Electronics	TP_VP
9	5001	TESTPOINT, THU, MINIATURE, 0.1LS, 120TL, BLACK	Test Point,Black	Keystone Electronics	TP1–TP5, TP14, TP21, TP23, TP25
5	5002	TESTPOINT, THU, MINIATURE, 0.1LS, 120TL, WHITE	Test Point,White	Keystone Electronics	TP6, TP_D0-TP_D2, TP_D7
1	5003	TESTPOINT, THU, MINIATURE, 0.1LS, 120TL, ORANGE	Test Point,Orange	Keystone Electronics	TP34
1	39357-0002	HEADER, THRU, POWER, 2P, 3.5MM, EUROSTYLE	CONN TERMINAL	Molex Connector Corp	P1
2	RESISTOR (DNI)	NOT INSTALLED	DNI		R169, R170
4	24436	STANDOFF HEX M3 THR ALUM 18MM	STANDOFF	Keystone	STANDOFF HEX M3 THR ALUM 18MM
4	29311	SCREW STEEL M3 THR 6MM	SCREW	Keystone	SCREW STEEL M3 THR 6MM

12 ADS5294EVM Printed-Circuit Board Layout

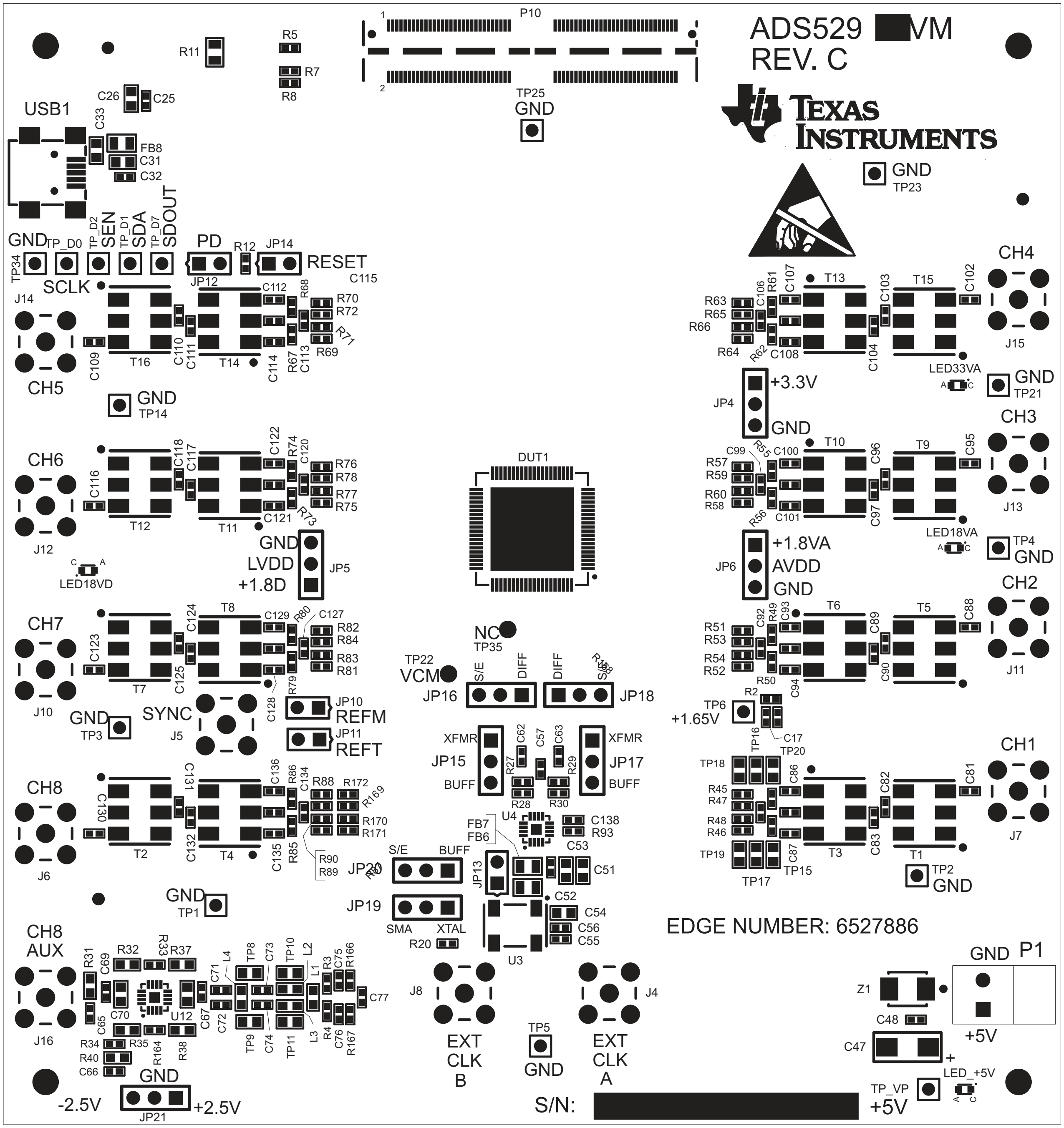


Figure 24. ADS5294EVM Top Layer Assembly Drawing – Top View

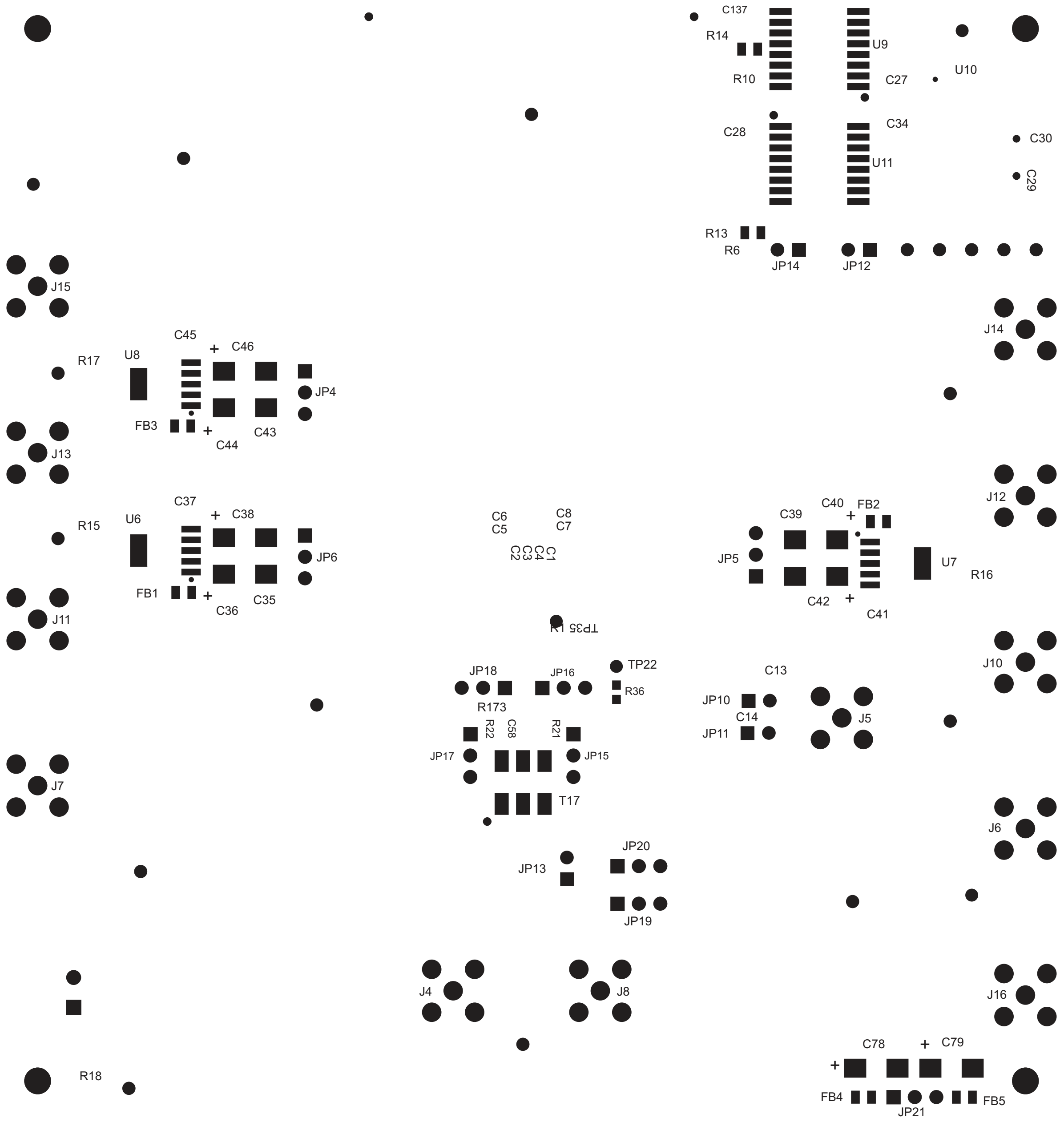


Figure 25. ADS5294EVM Bottom Layer Assembly Drawing – Bottom View

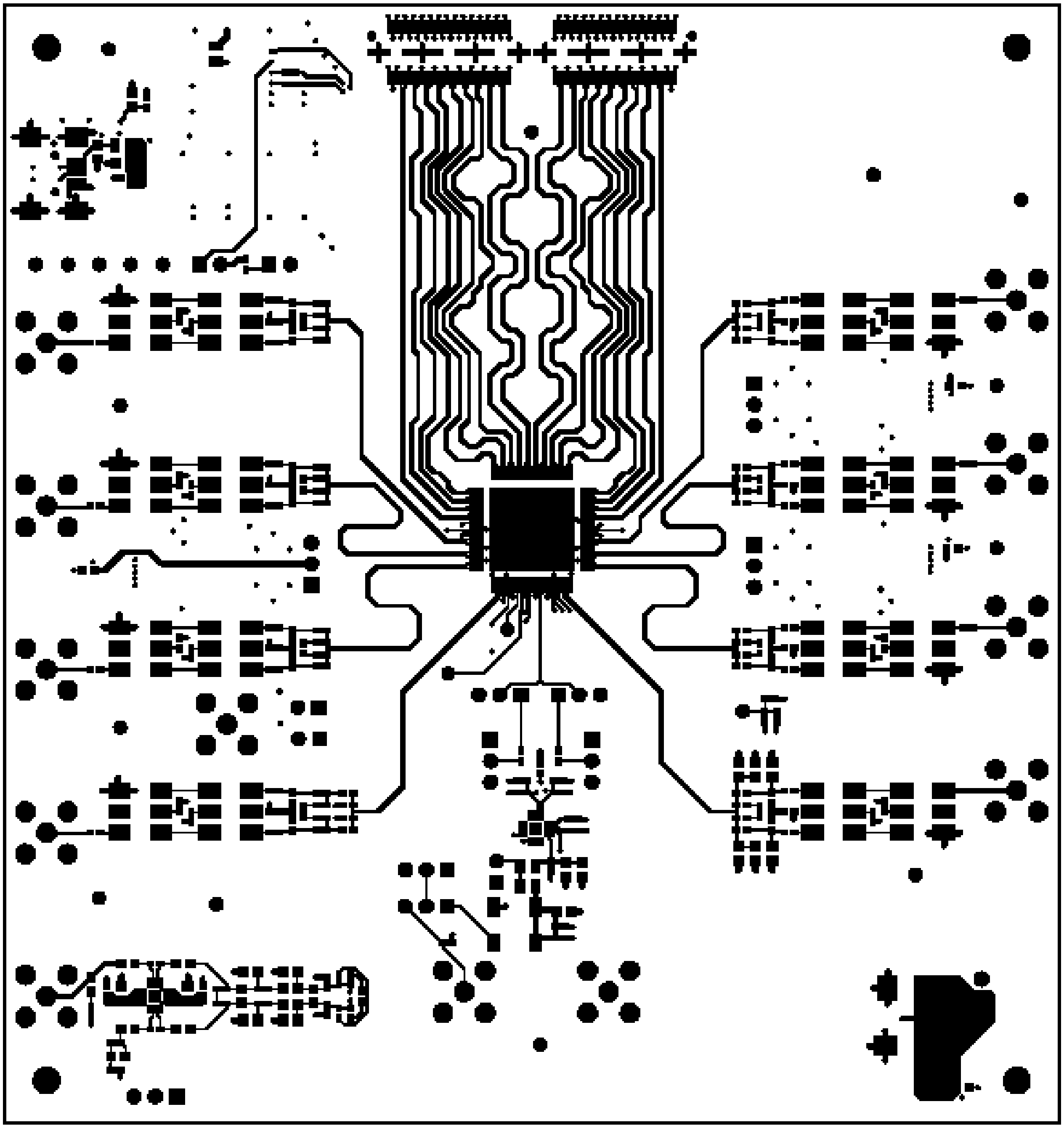


Figure 26. ADS5294EVM Top Layer Copper – Top View

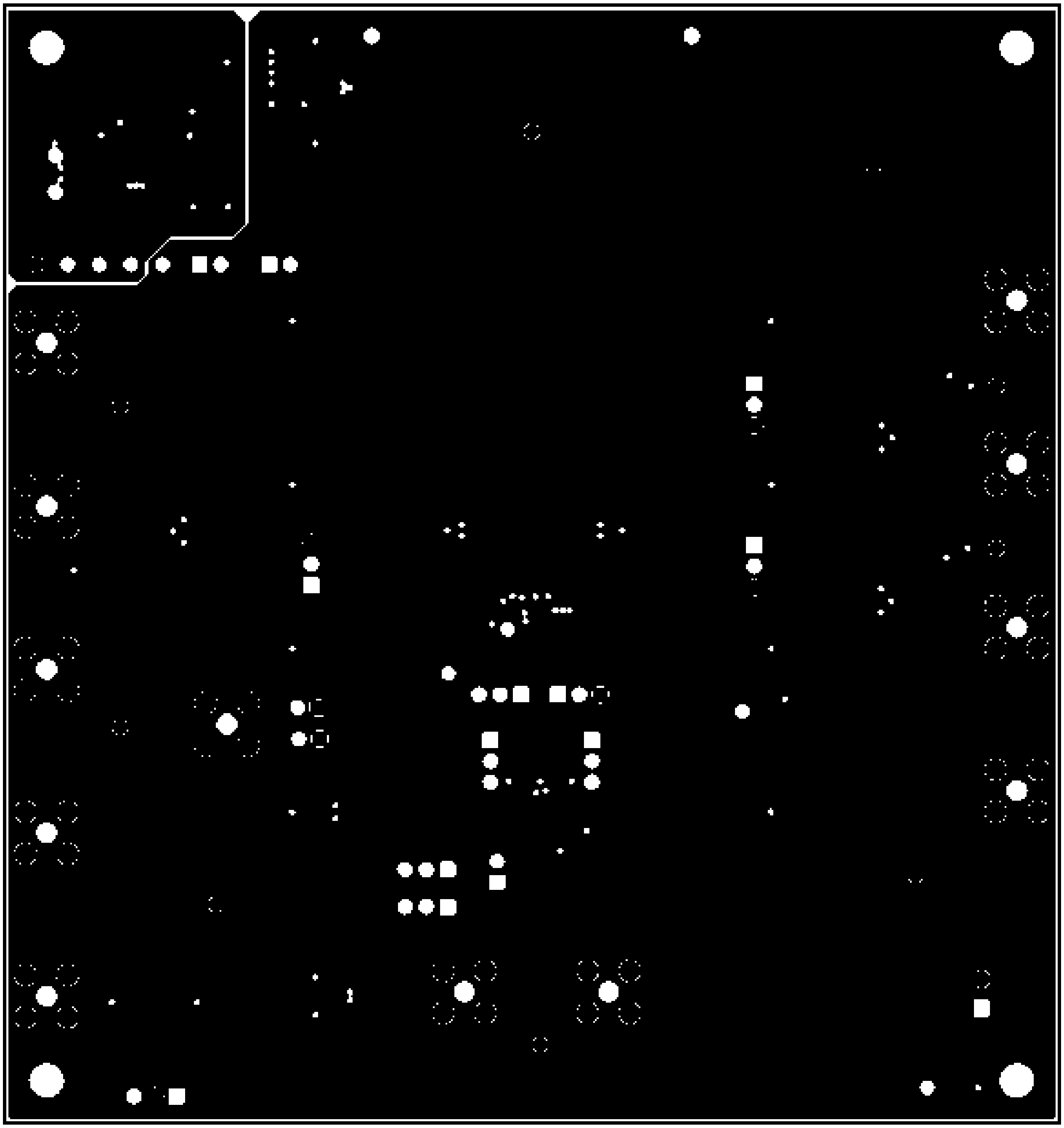


Figure 27. ADS5294EVM Internal Layer 1, Ground – Top View

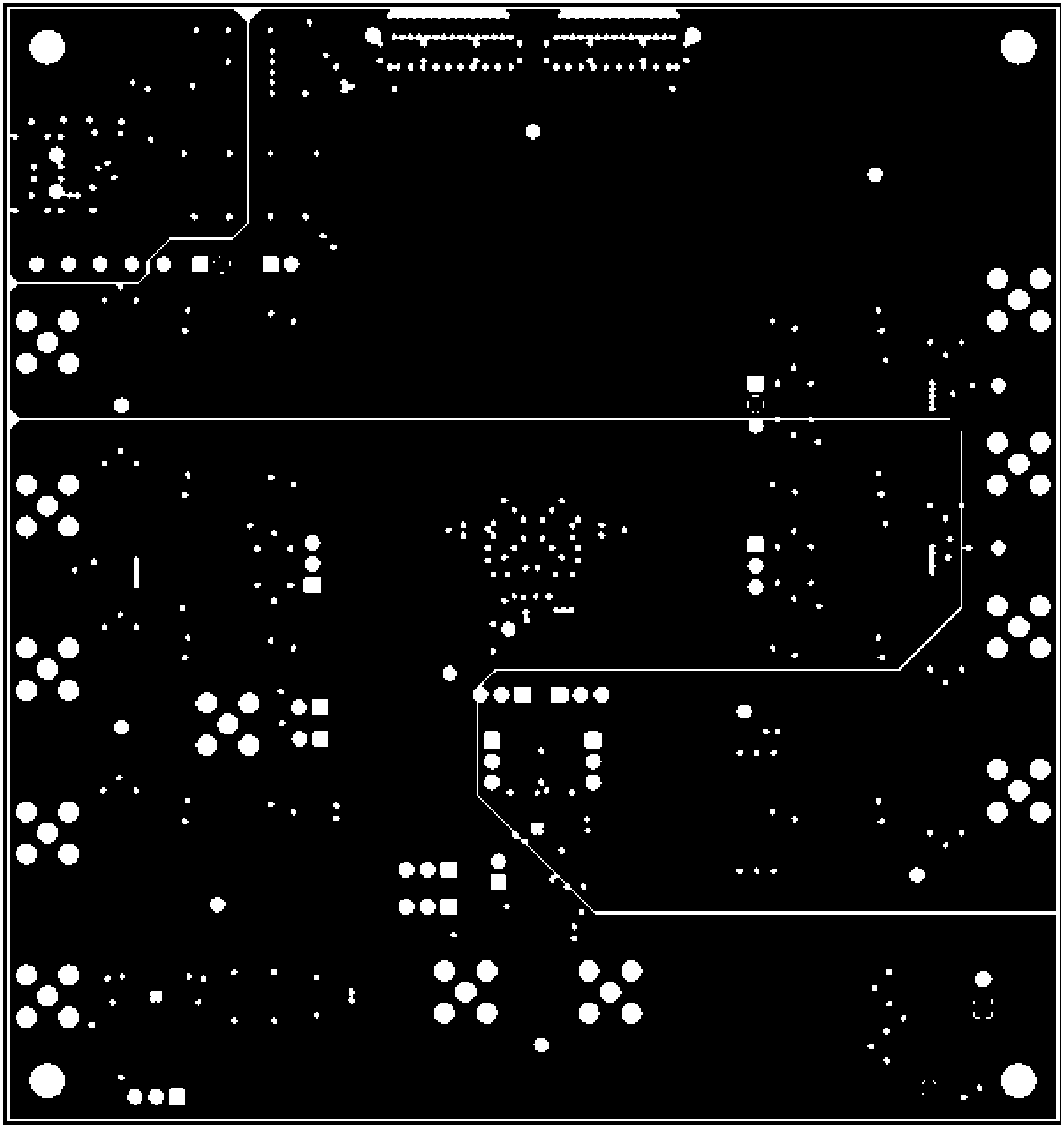


Figure 28. ADS5294EVM Internal Layer 2, Power – Top View

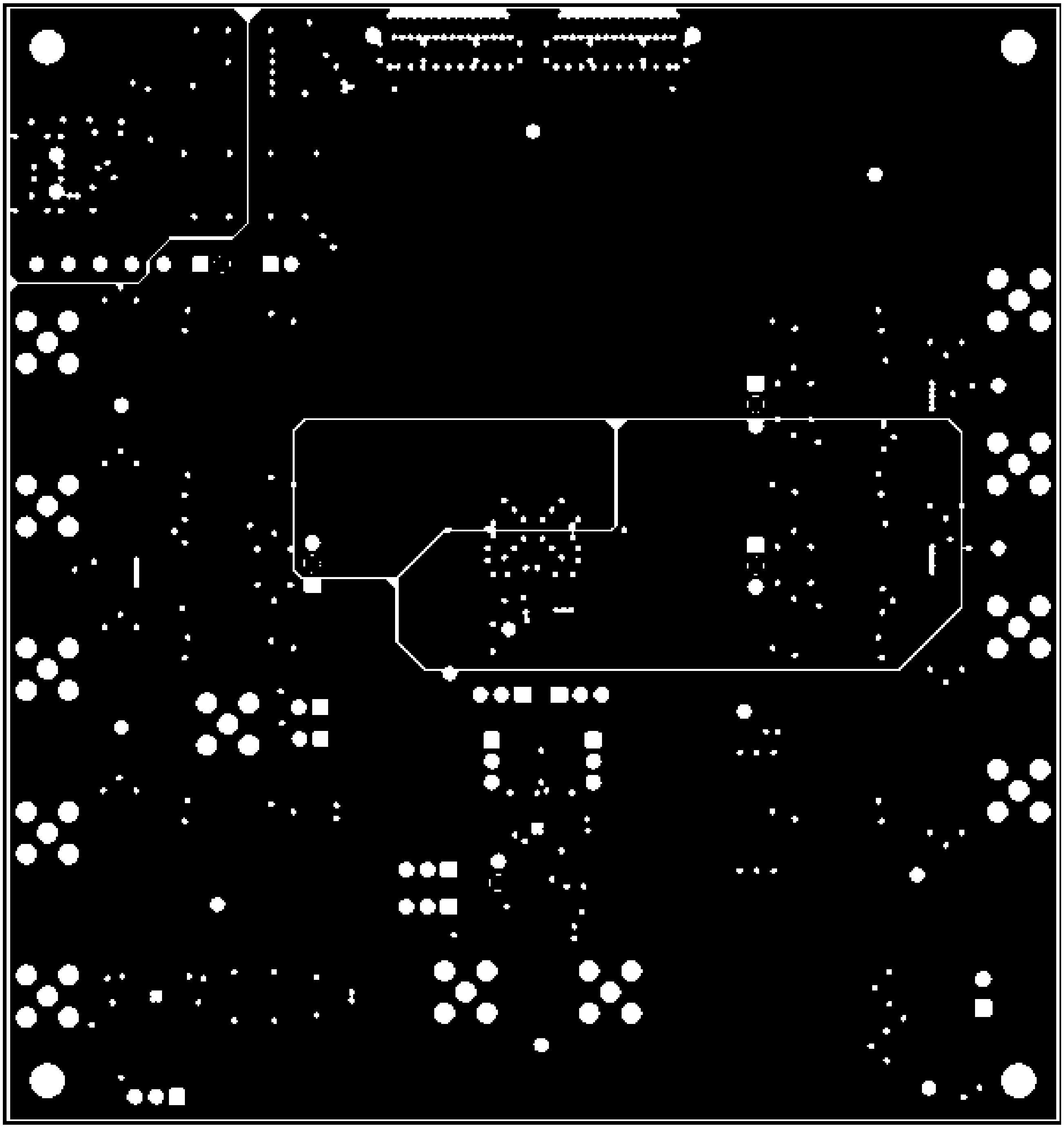


Figure 29. ADS5294EVM Internal Layer 3, Power – Top View

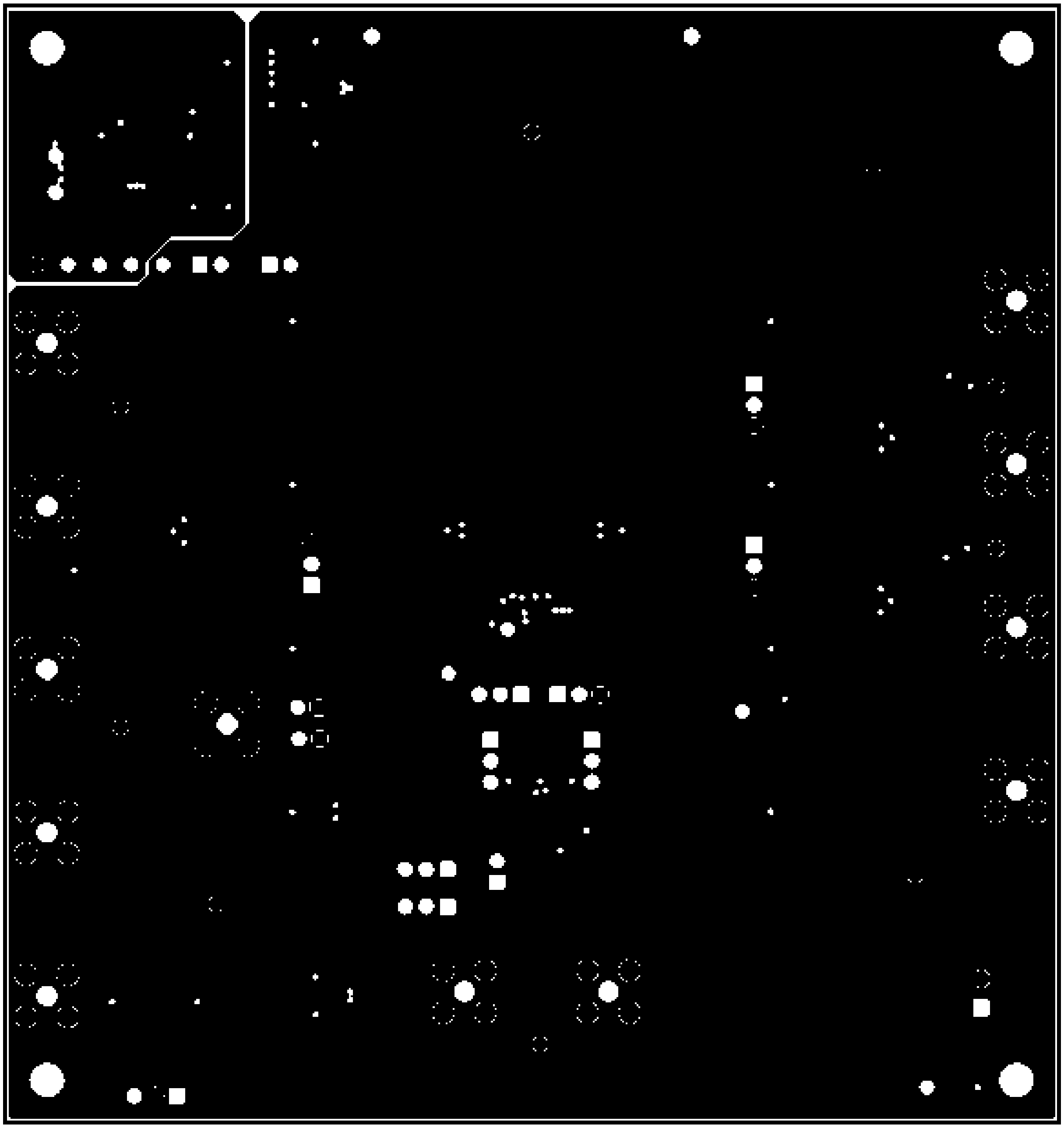


Figure 30. ADS5294EVM Internal Layer 4, Ground – Top View

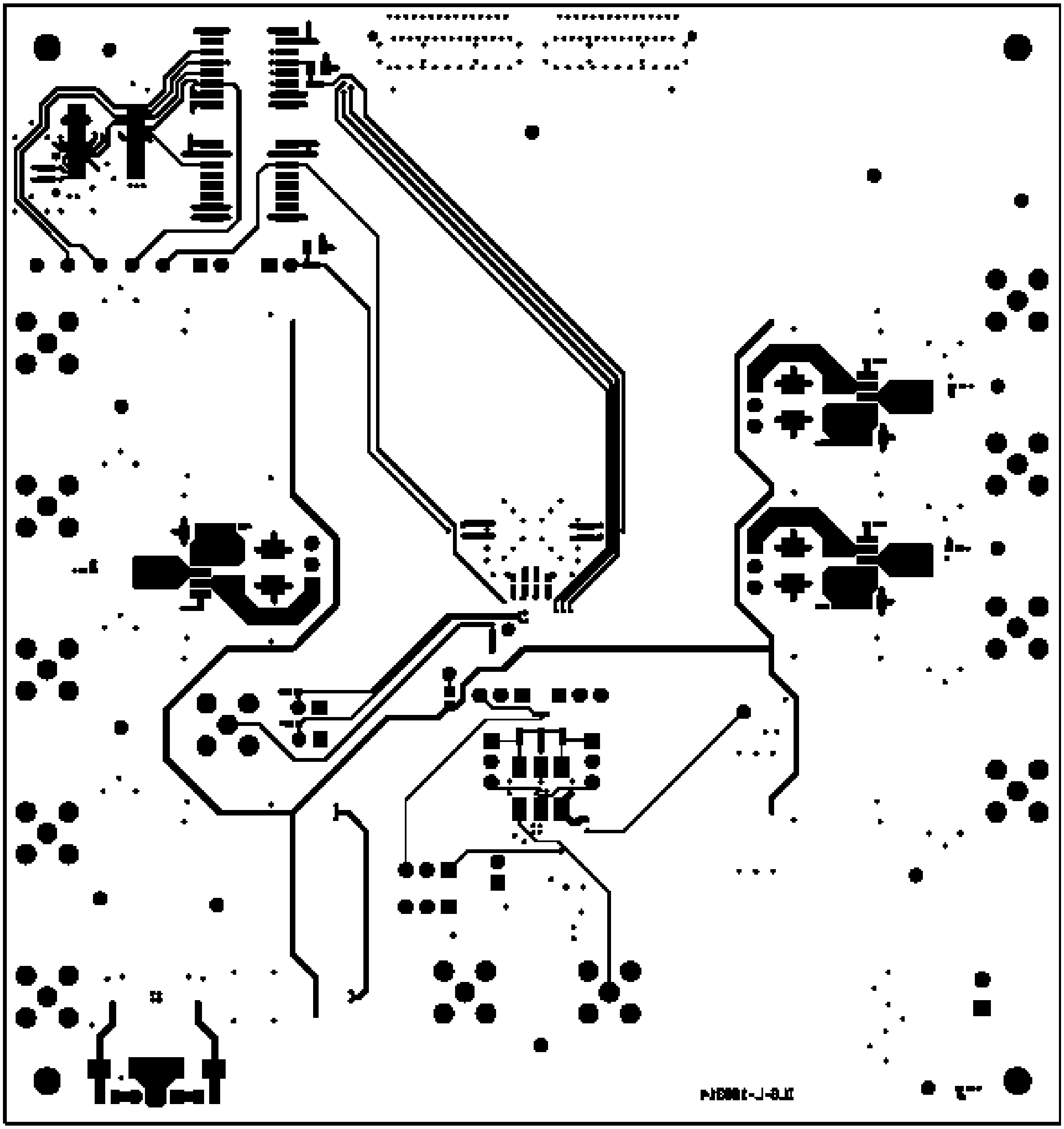


Figure 31. ADS5294EVM Bottom Layer Copper – Top View

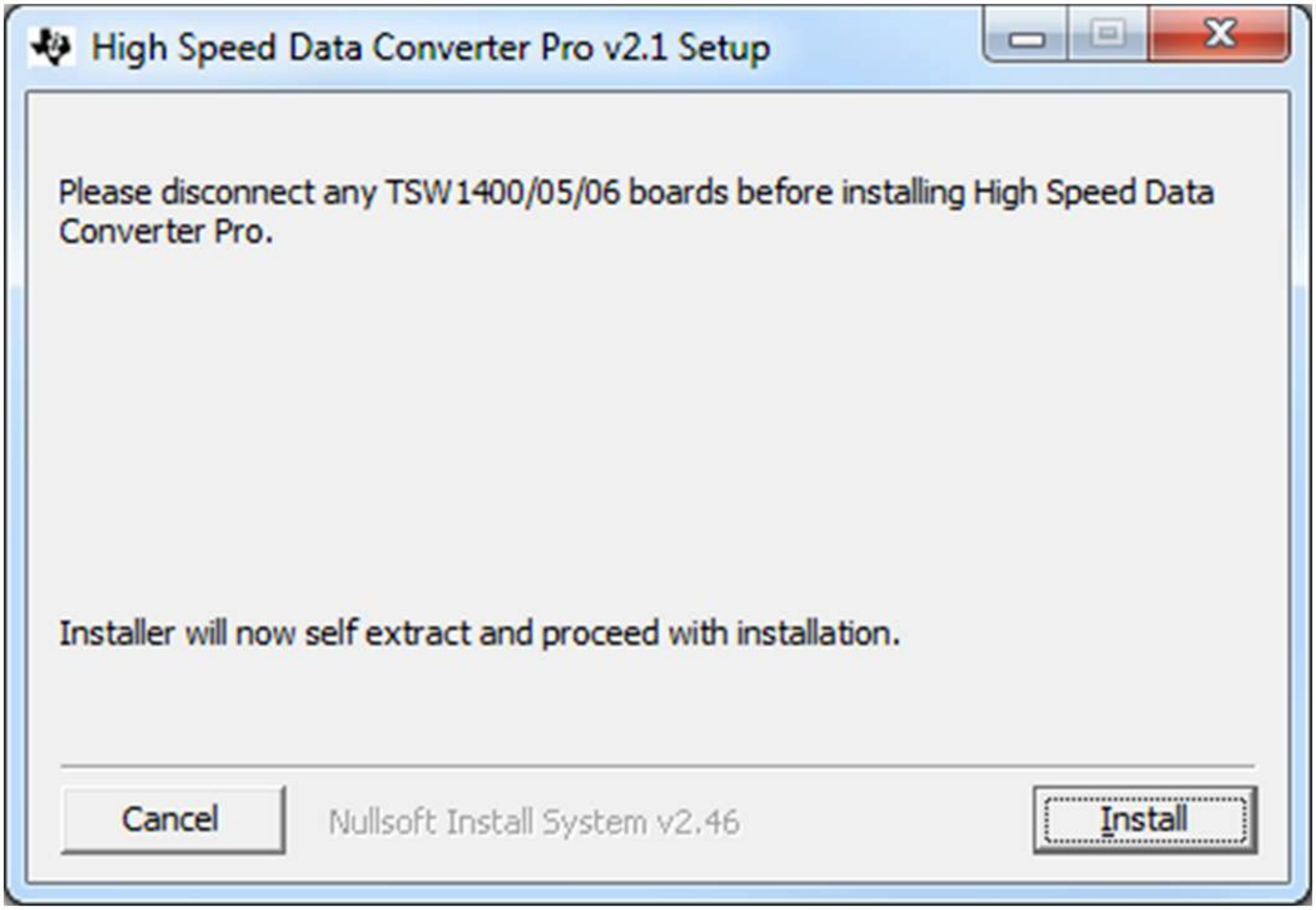
Appendix A

SLAU355A–July 2011–Revised March 2015

High Speed Data Converter Pro (HSDCPro) GUI Installation

Download the HSDCPro GUI Installer using this link: HSDCPro GUI

- Unzip the saved folder and run the installer executable to obtain the pop-up shown in Figure 32.
- Click the *Install* button.

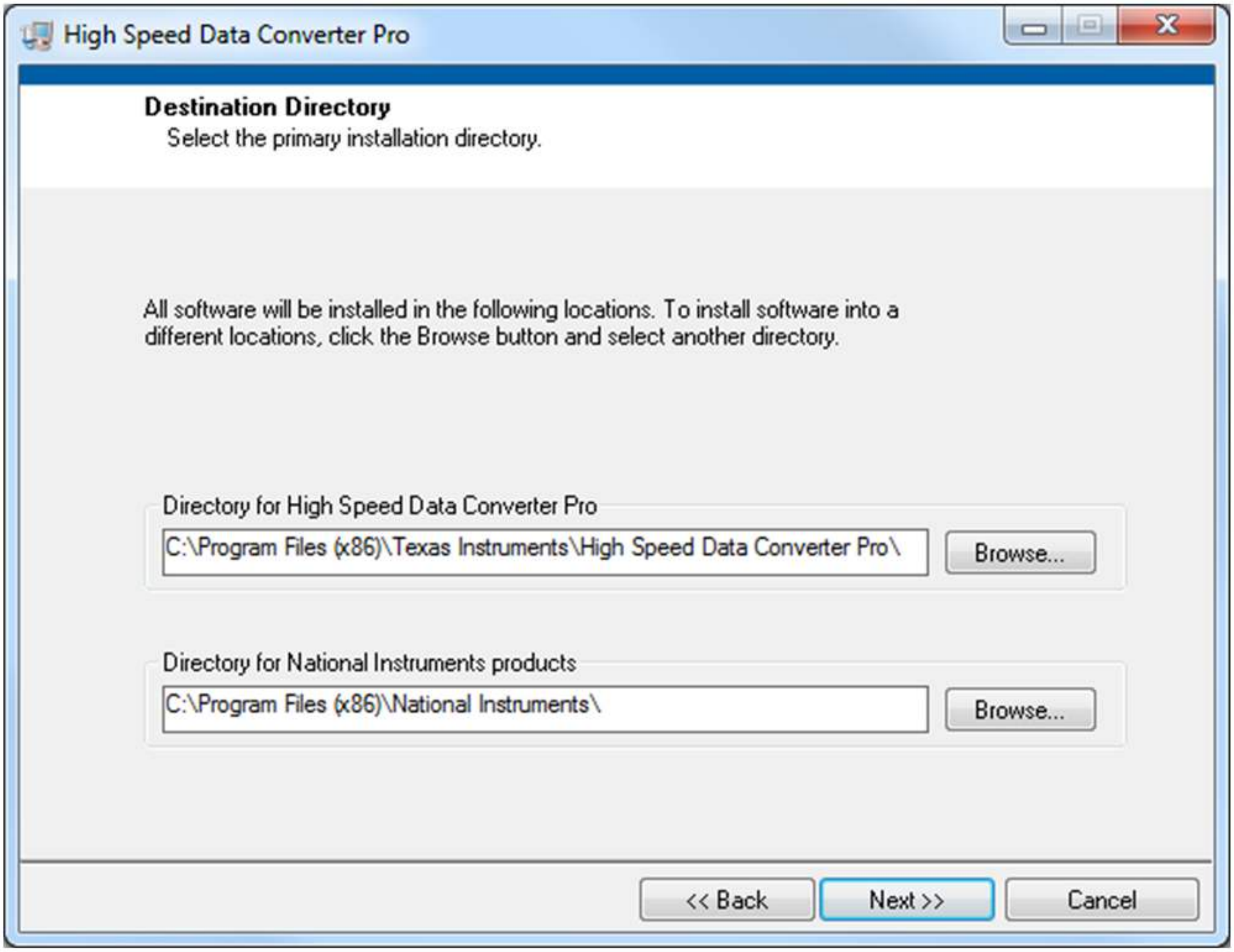


Please disconnect any TSW1400/05/06 boards before installing High Speed Data Converter Pro.

Installer will now self extract and proceed with installation.

Figure 32. HSDCPro Install (Begin)

- Leave the destination directories as the default location, for the TSW1400GUI installation and press the NEXT button as shown in Figure 33.



Destination Directory

Select the primary installation directory.

All software will be installed in the following locations. To install software into a different locations, click the Browse button and select another directory.

Directory for High Speed Data Converter Pro

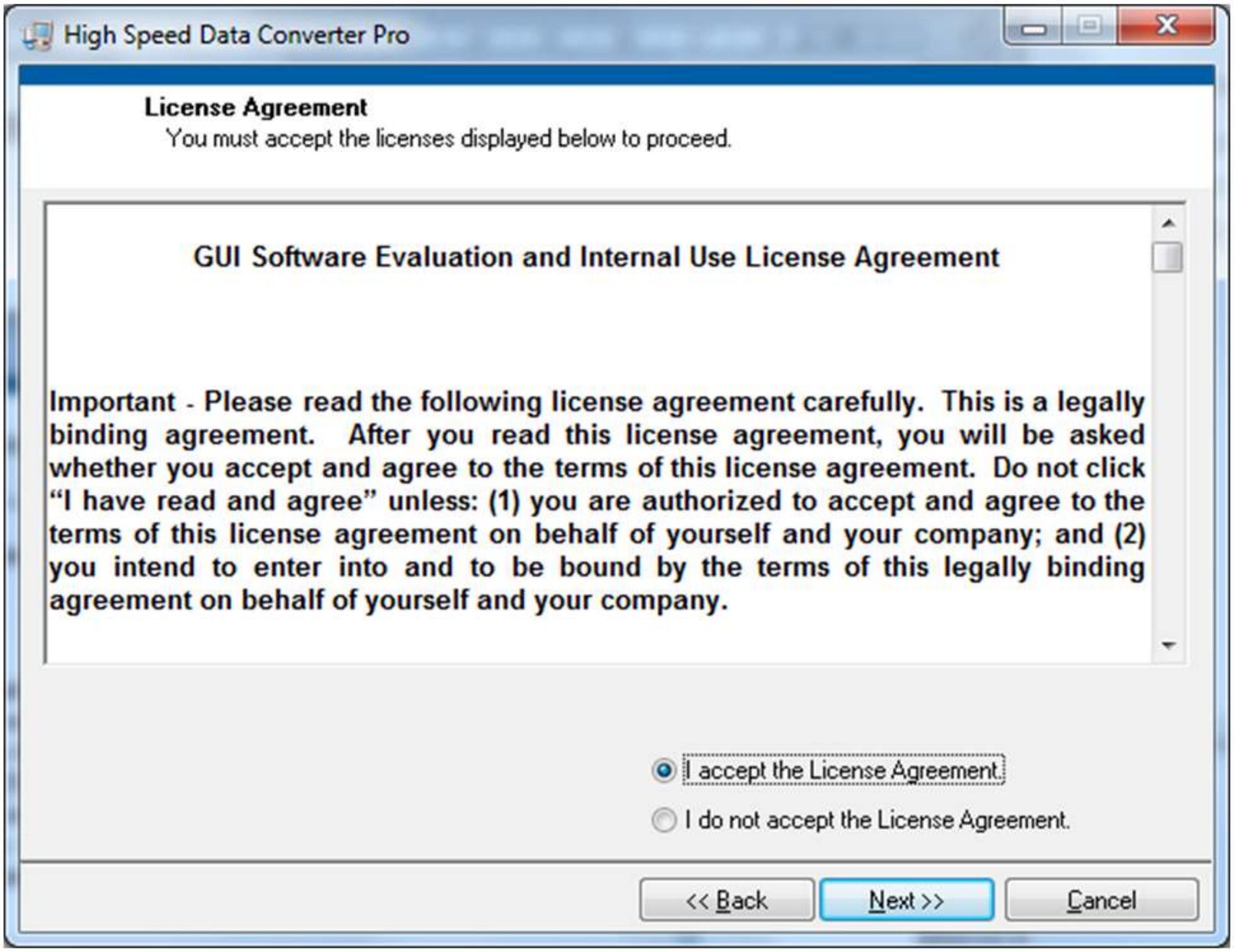
C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro\

Directory for National Instruments products

C:\Program Files (x86)\National Instruments\

Figure 33. HSDCPro Install (Install Directory)

- Read the License Agreement from Texas Instruments and select *I accept the License Agreement* and press the *Next* button as shown in Figure 34.



License Agreement

You must accept the licenses displayed below to proceed.

GUI Software Evaluation and Internal Use License Agreement

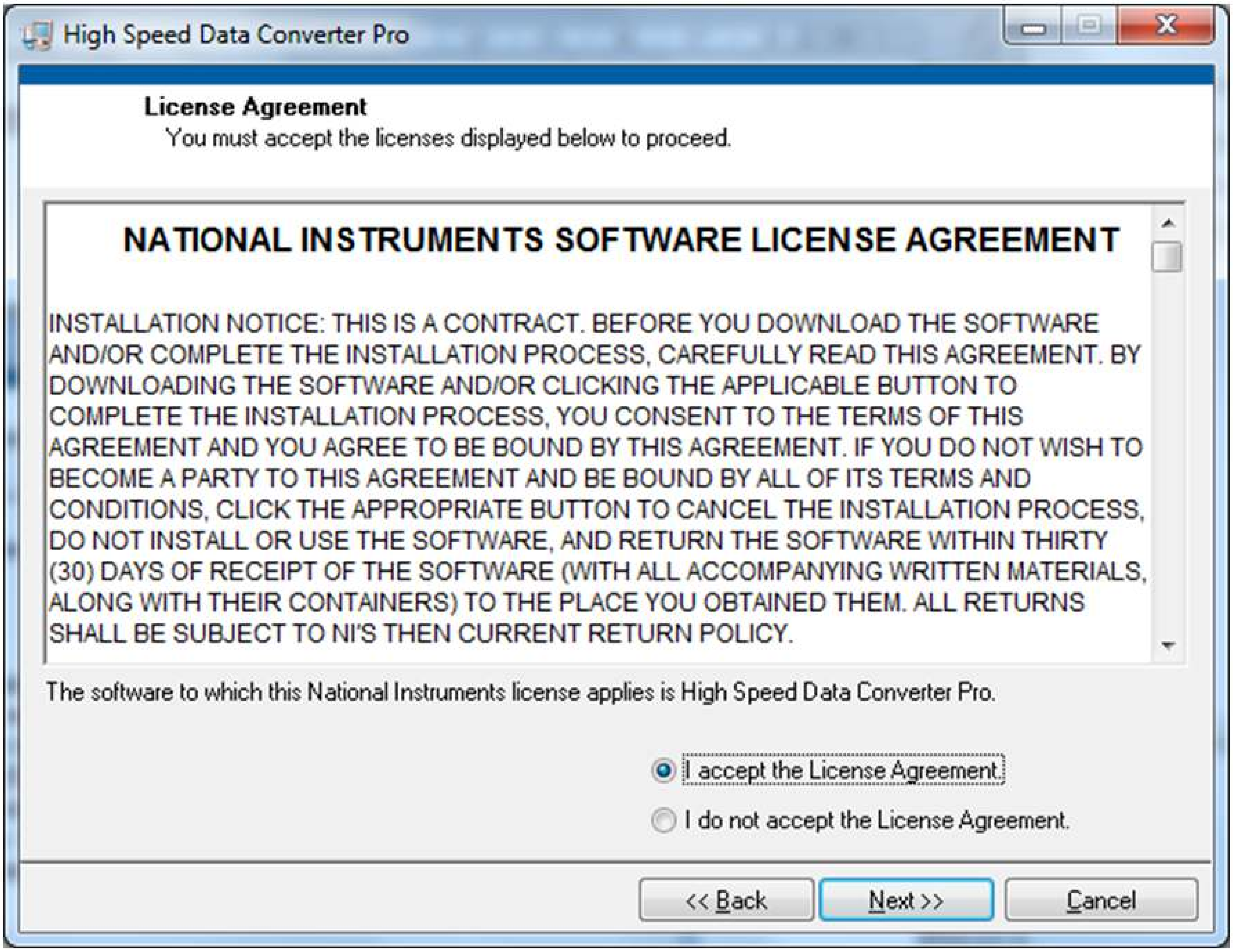
Important - Please read the following license agreement carefully. This is a legally binding agreement. After you read this license agreement, you will be asked whether you accept and agree to the terms of this license agreement. Do not click "I have read and agree" unless: (1) you are authorized to accept and agree to the terms of this license agreement on behalf of yourself and your company; and (2) you intend to enter into and to be bound by the terms of this legally binding agreement on behalf of yourself and your company.

● I accept the License Agreement.

○ I do not accept the License Agreement.

Figure 34. HSDCPro Install (TI License Agreement)

- Read the License Agreement from National Instruments and select *I accept the License Agreement* and press the *Next* button as shown in Figure 35.



License Agreement

You must accept the licenses displayed below to proceed.

NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEMENT

INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE INSTALLATION PROCESS, DO NOT INSTALL OR USE THE SOFTWARE, AND RETURN THE SOFTWARE WITHIN THIRTY (30) DAYS OF RECEIPT OF THE SOFTWARE (WITH ALL ACCOMPANYING WRITTEN MATERIALS, ALONG WITH THEIR CONTAINERS) TO THE PLACE YOU OBTAINED THEM. ALL RETURNS SHALL BE SUBJECT TO NI'S THEN CURRENT RETURN POLICY.

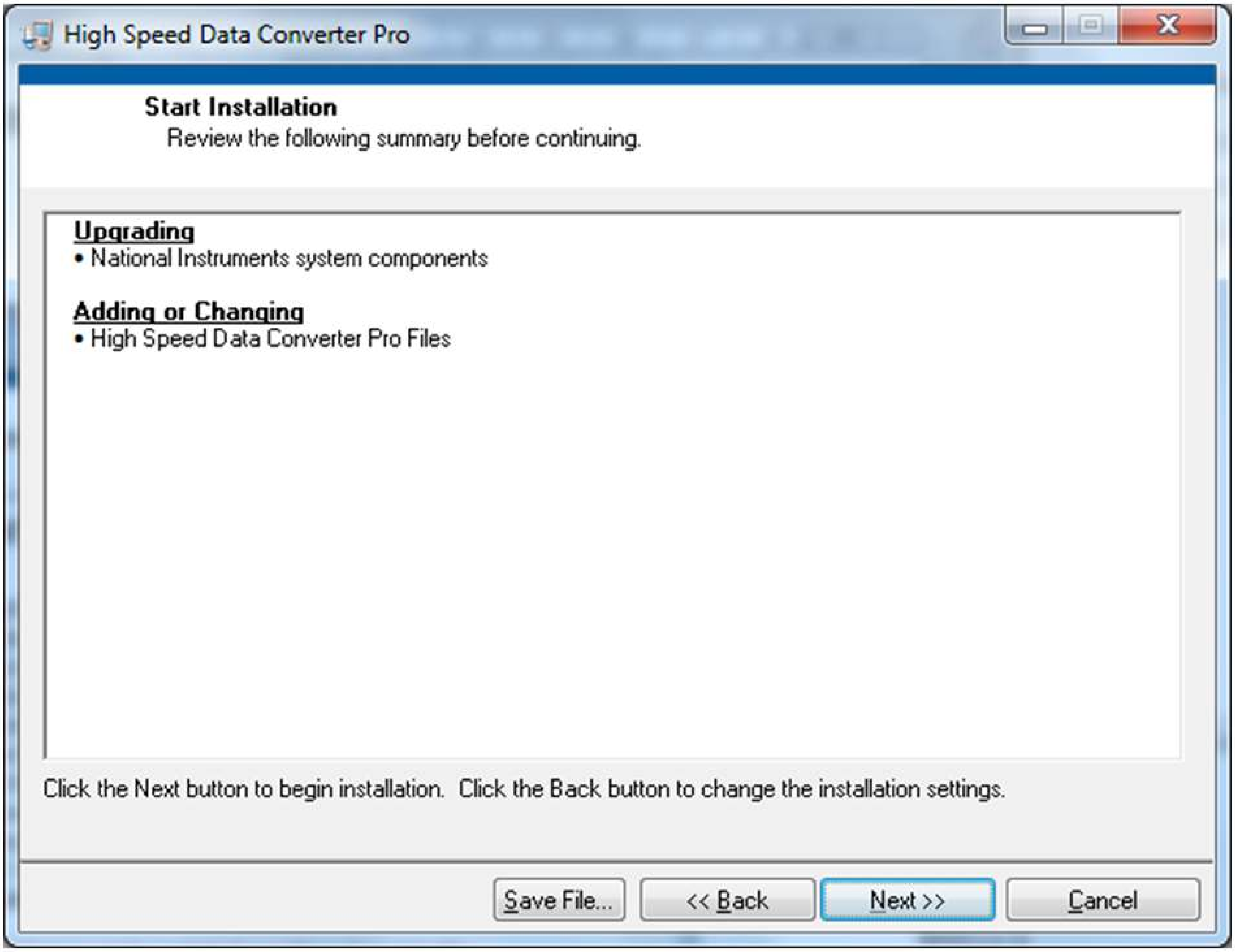
The software to which this National Instruments license applies is High Speed Data Converter Pro.

● I accept the License Agreement.

○ I do not accept the License Agreement.

Figure 35. HSDCPro Install (NI License Agreement)

- Press the *Next* button as shown in Figure 36.



Start Installation

Review the following summary before continuing.

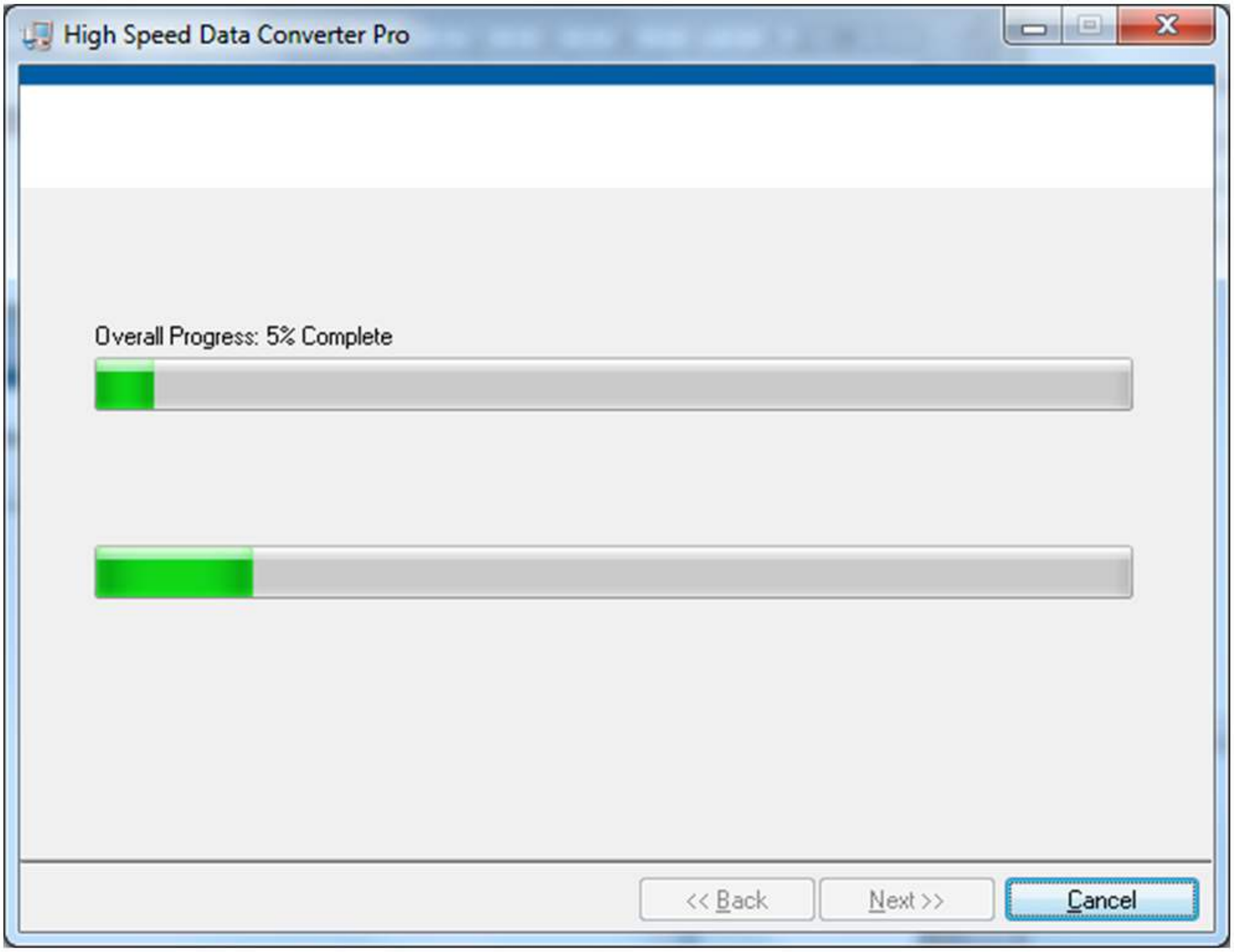
Upgrading
- National Instruments system components

Adding or Changing
- High Speed Data Converter Pro Files

Click the Next button to begin installation. Click the Back button to change the installation settings.

Figure 36. HSDCPro Install (Start Installation)

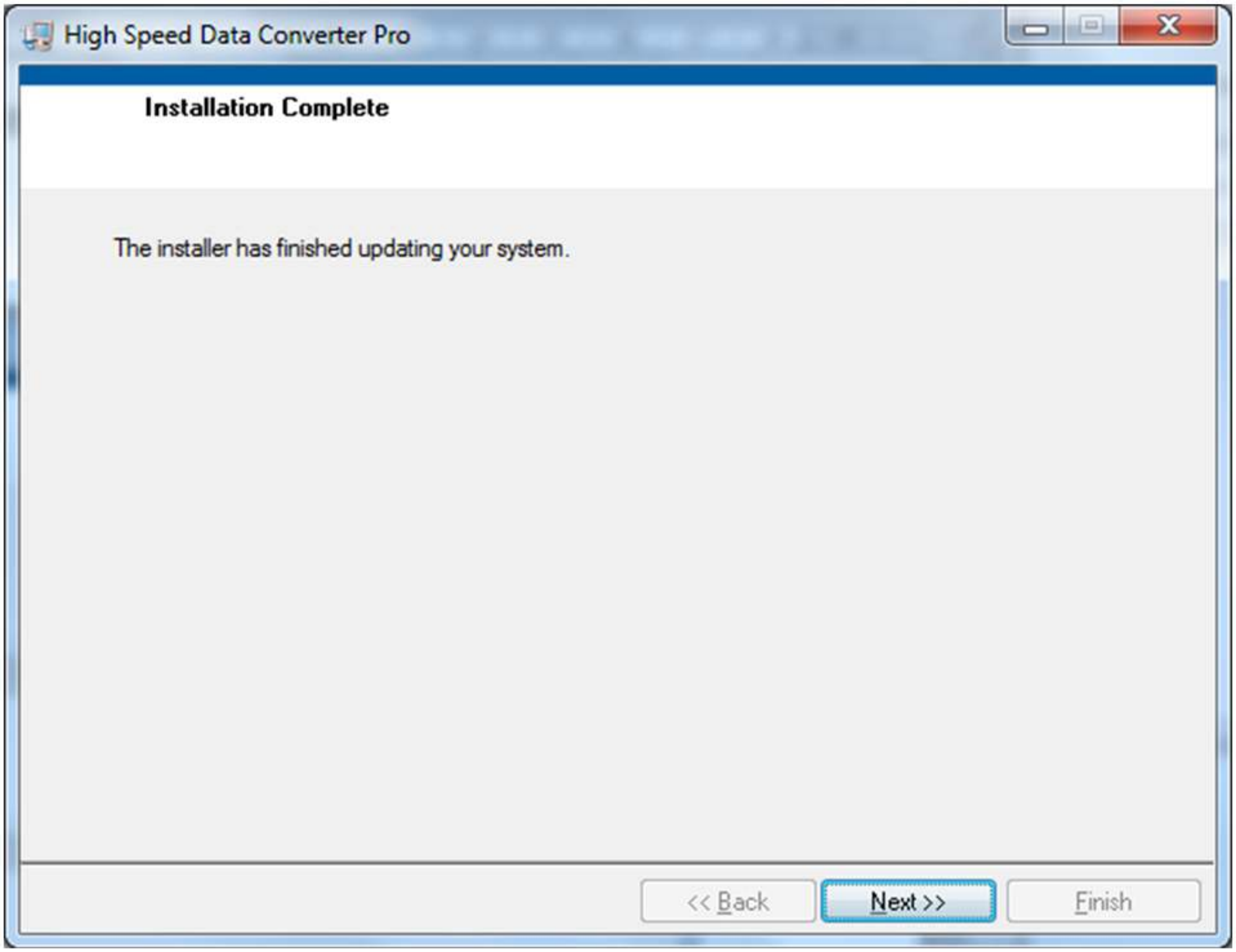
- The window shown in Figure 37 should appear indicating that the installation is in progress.



Overall Progress: 5% Complete

Figure 37. HSDCPro Install (Installation Progress)

- The window shown in Figure 38 appears indicating *Installation Complete*. Press the *Next* button.

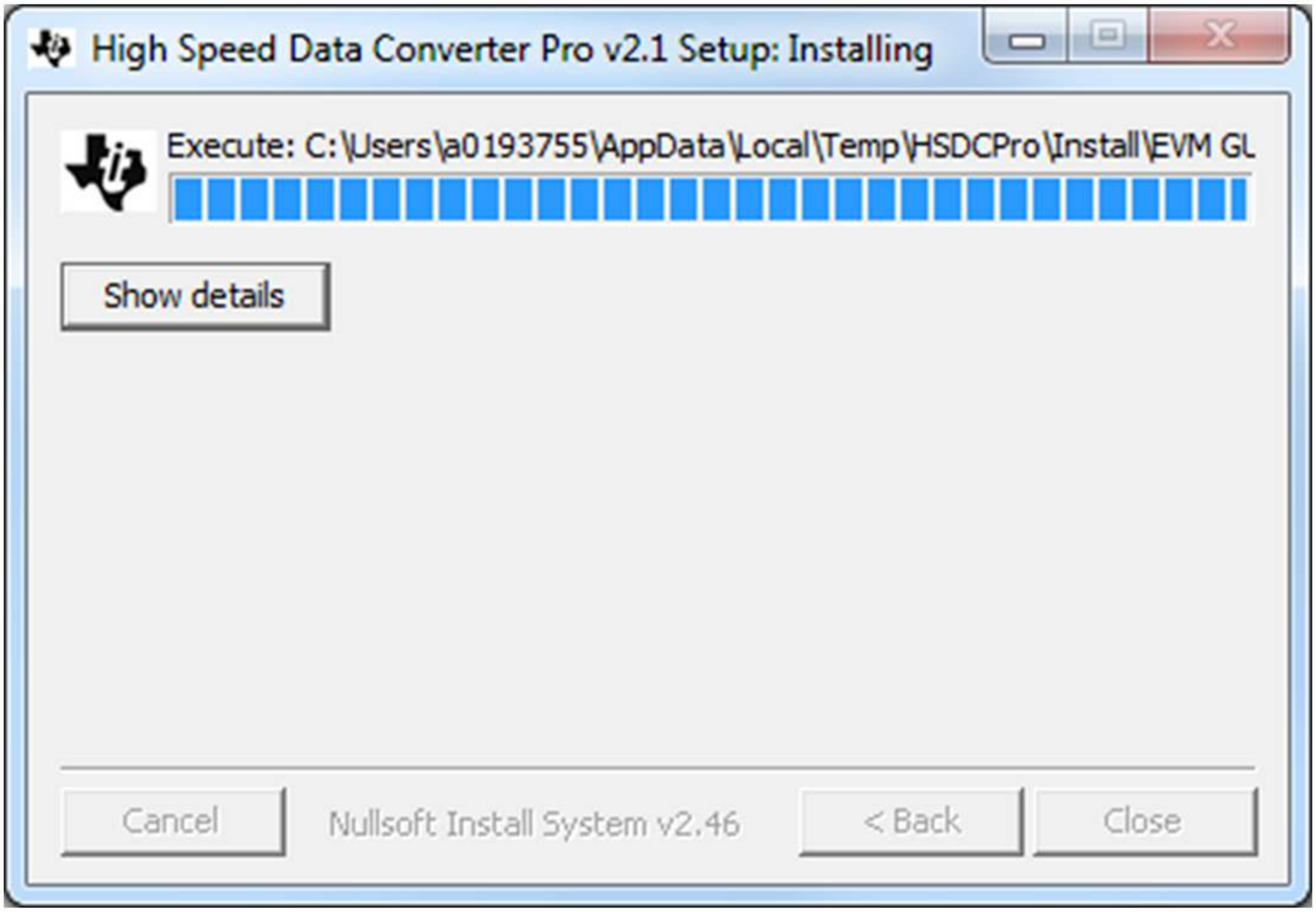


Installation Complete

The installer has finished updating your system.

Figure 38. HSDCPro Install (Installation Complete)

- The window shown in Figure 39 appears briefly to complete the process.

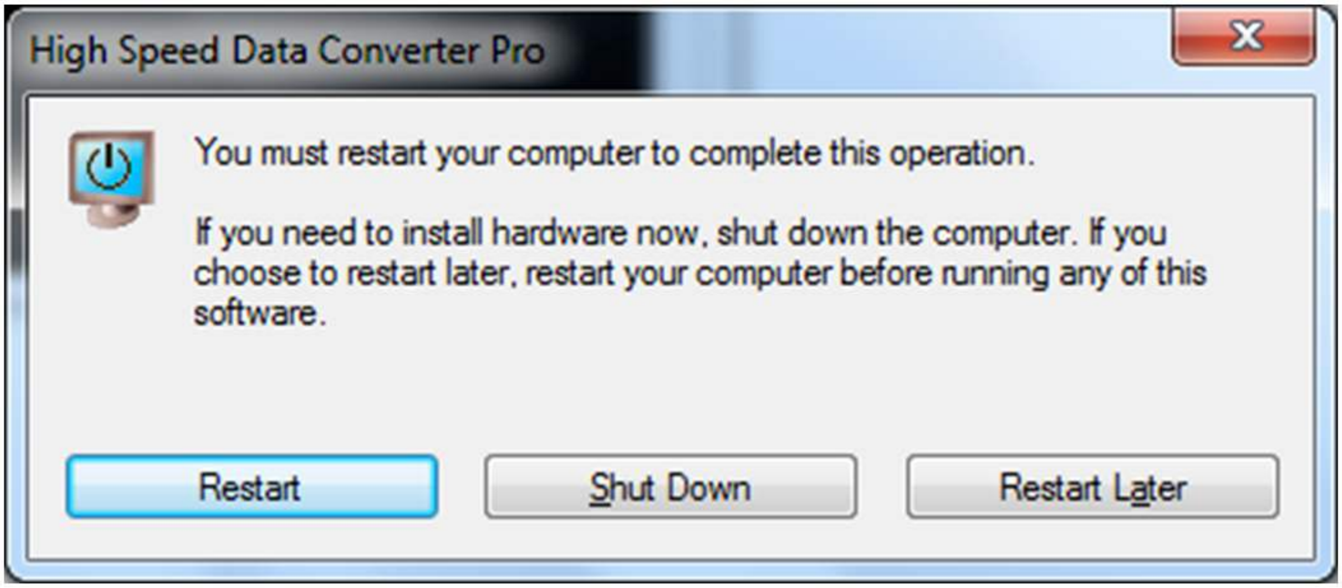


High Speed Data Converter Pro v2.1 Setup: Installing

Execute: C:\Users\a0193755\AppData\Local\Temp\HSDCPro\Install\EVM GL

Figure 39. HSDCPro Install (h)

- As shown in Figure 40 a restart might be requested depending on whether or not the PC already had the National Instruments MCR Installer. If requested, hit the *Restart* button to complete the installation.



High Speed Data Converter Pro

You must restart your computer to complete this operation.

If you need to install hardware now, shut down the computer. If you choose to restart later, restart your computer before running any of this software.

Figure 40. HSDCPro Install

Revision History

Changes from Original (July 2011) to A Revision **Page**

- Added Appendix A: High Speed Data Converter Pro (HSDCPro) GUI Installation. 41

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

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 are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in 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.

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本開発キットは技術基準適合証明を受けておりません。

本製品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。

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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
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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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