User's Guide
SLAU355–July 2011

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), TSW1250EVM, external equipment, personal computer (PC), and software requirements.

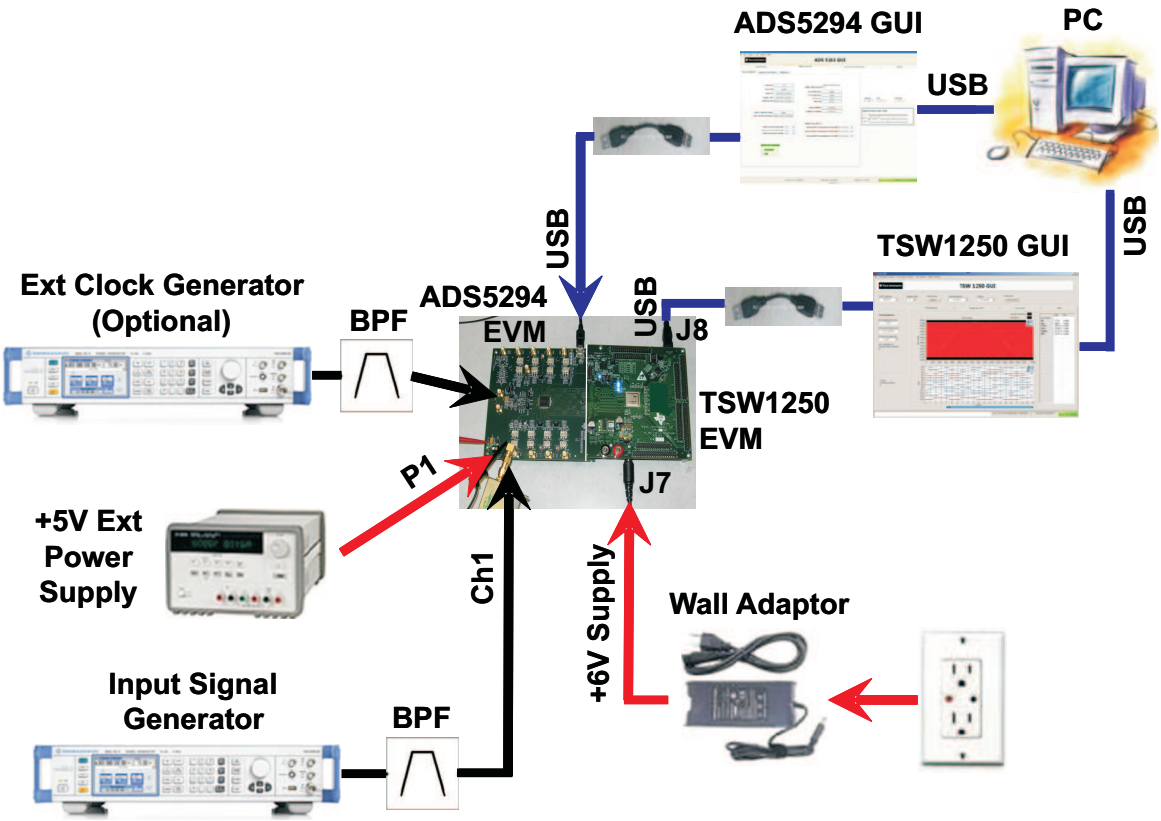


Figure 1. Evaluation Setup

TSW1250EVM: The high-speed LVDS deserializer board is required for capturing data from the ADS5294EVM and its analysis using the TSW1250 graphical user interface (GUI).

For more information pertaining to be TSW1250EVM, see:
http://focus.ti.com/docs/toolsw/folders/print/tsw1250evm.html.

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 TSW1250EVM using a wall adapter.

USB Interface to PC: The USB connection from the ADS5294EVM and TSW1250EVM 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

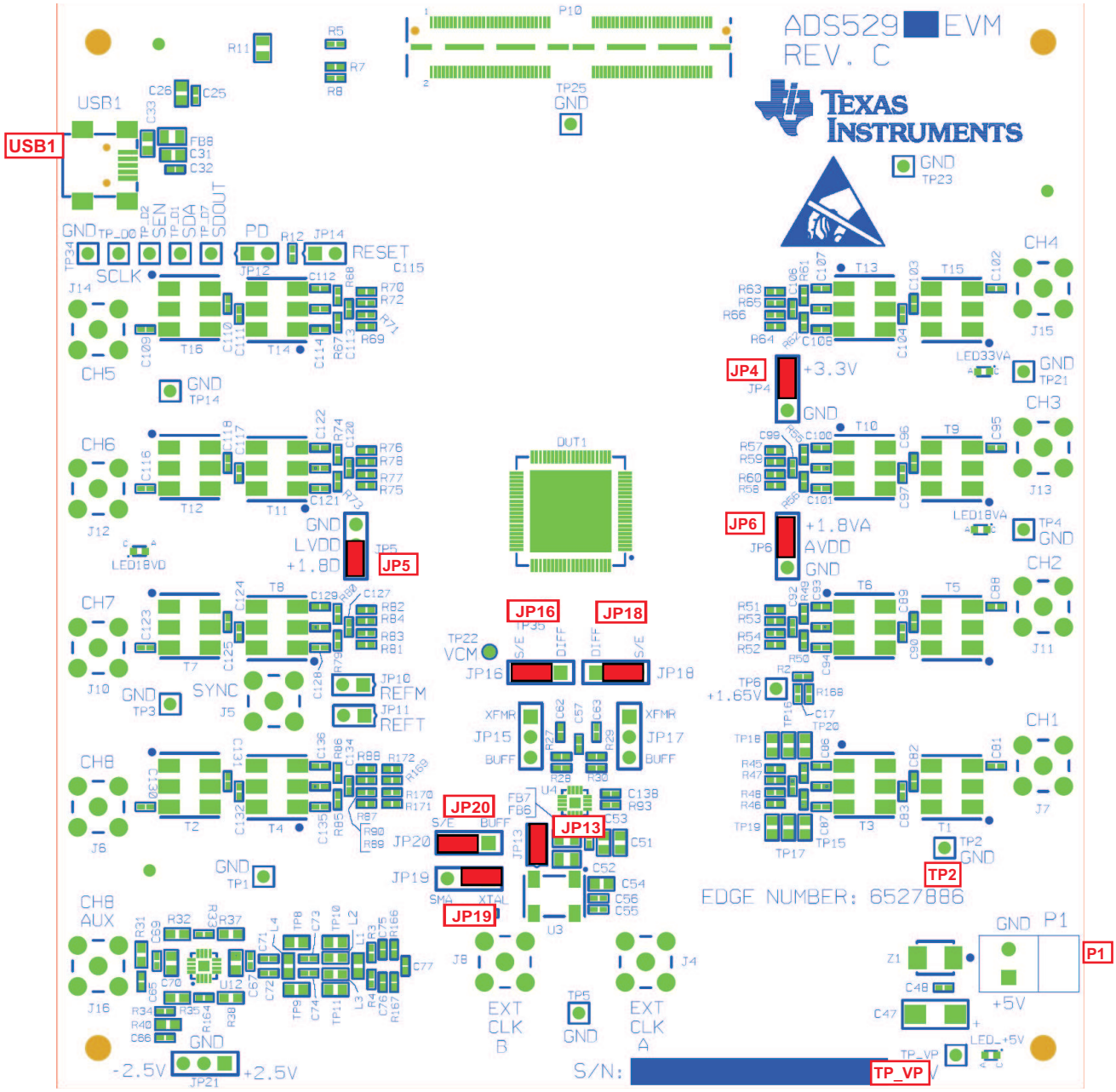


Figure 2. ADS5294EVM Basic Configuration

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

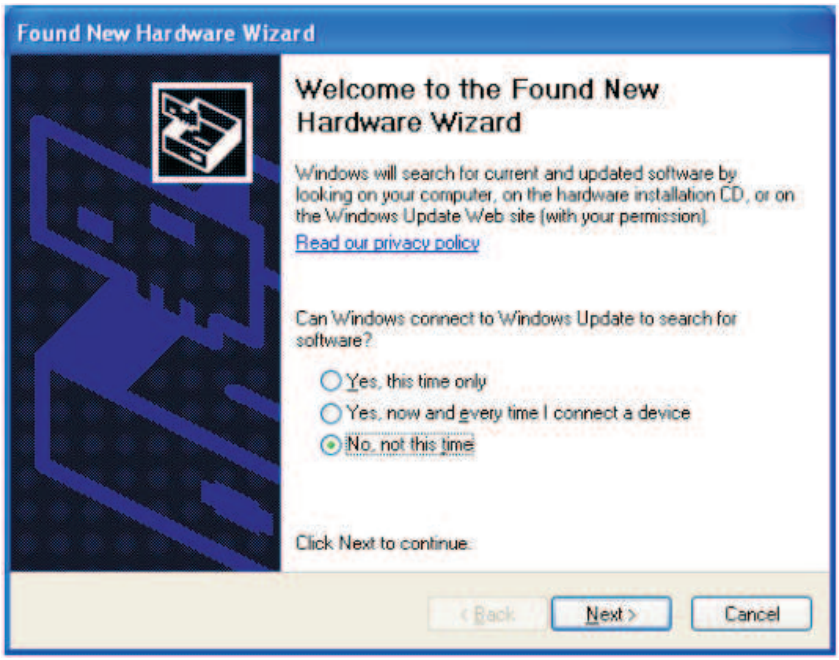
The ADS5294EVM comes with a software installation CD; run setup.exe to install the software.

3.1 GUI Installation – Mandatory

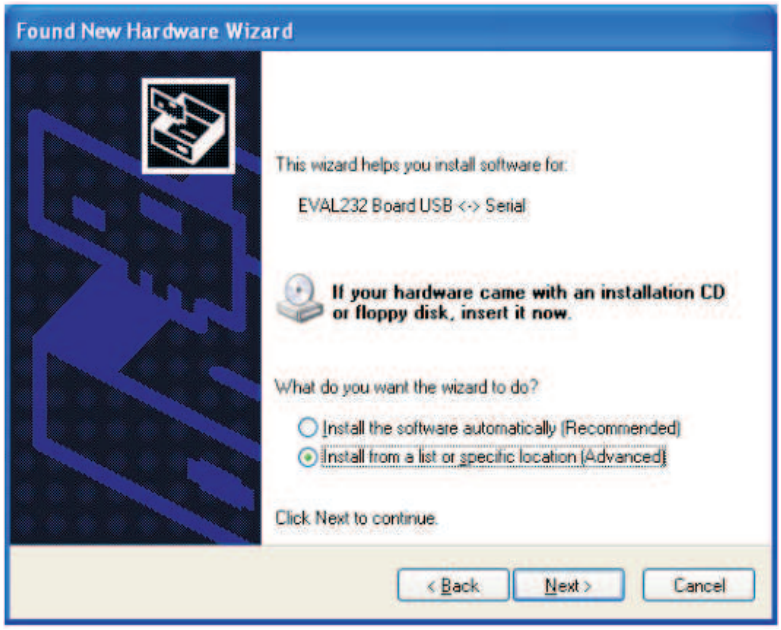
Unzip the installer file in the CD. Run **setup.exe** to install the GUI.

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



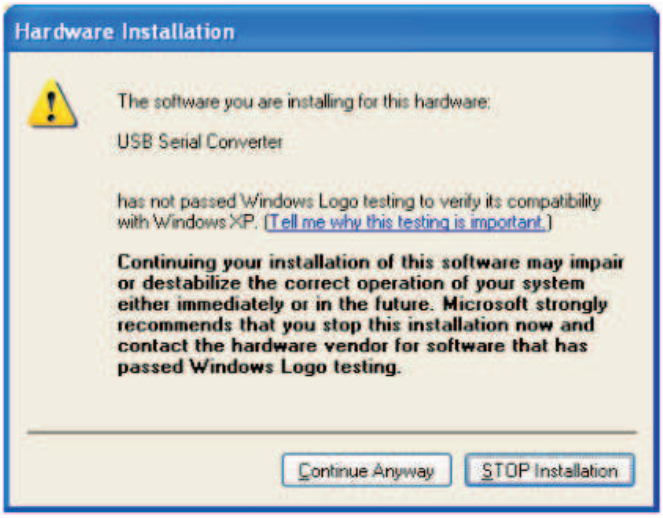
- Select *Install from a list or specific location (Advanced)* as shown in the following illustration, and then click *Next*.



- 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.



4 Test Setup

To evaluate the ADS5294 device, a TSW1250EVM 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 TSW1250EVM using **P10** connector.
- Connect USB cable from PC to USB port **J8** of TSW1250EVM.
- Connect +6-V wall adapter to TSW1250EVM 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.

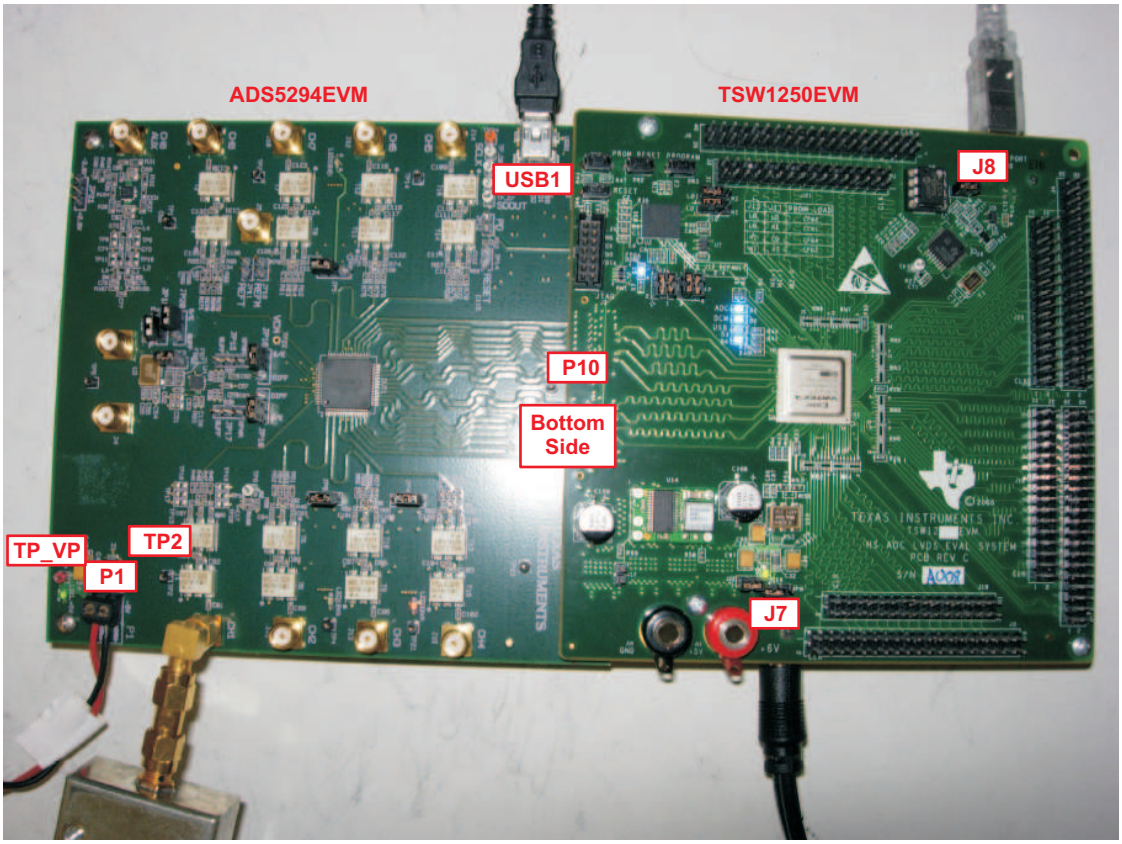


Figure 3. HW Setup With Connection Between TSW1250EVM and ADS5294EVM

5 Power Up ADS5294

After connecting the ADS5294EVM to the TSW1250 using the **P10** connector, +6-V adapter to TSW1250EVM, 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).

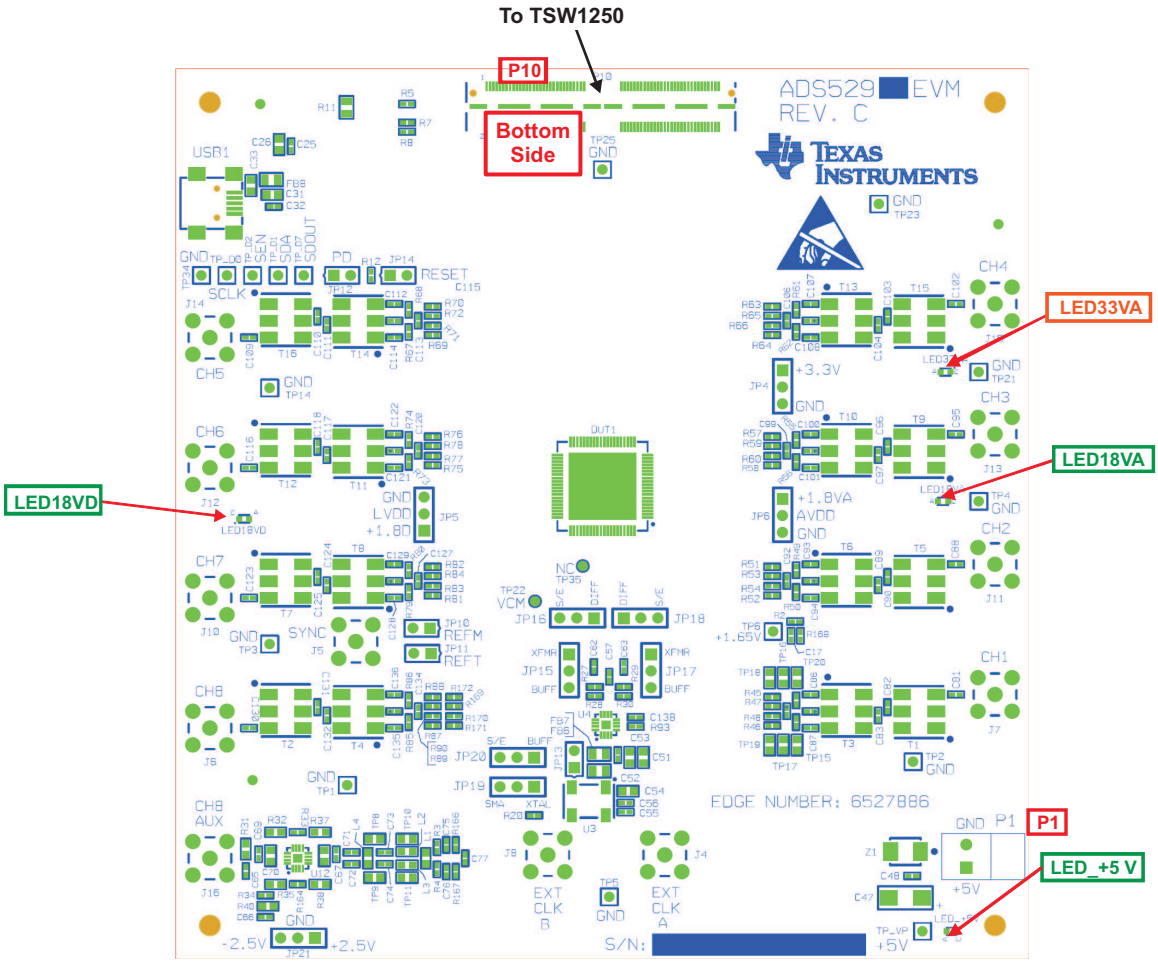


Figure 4. Power-Up Indications

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.

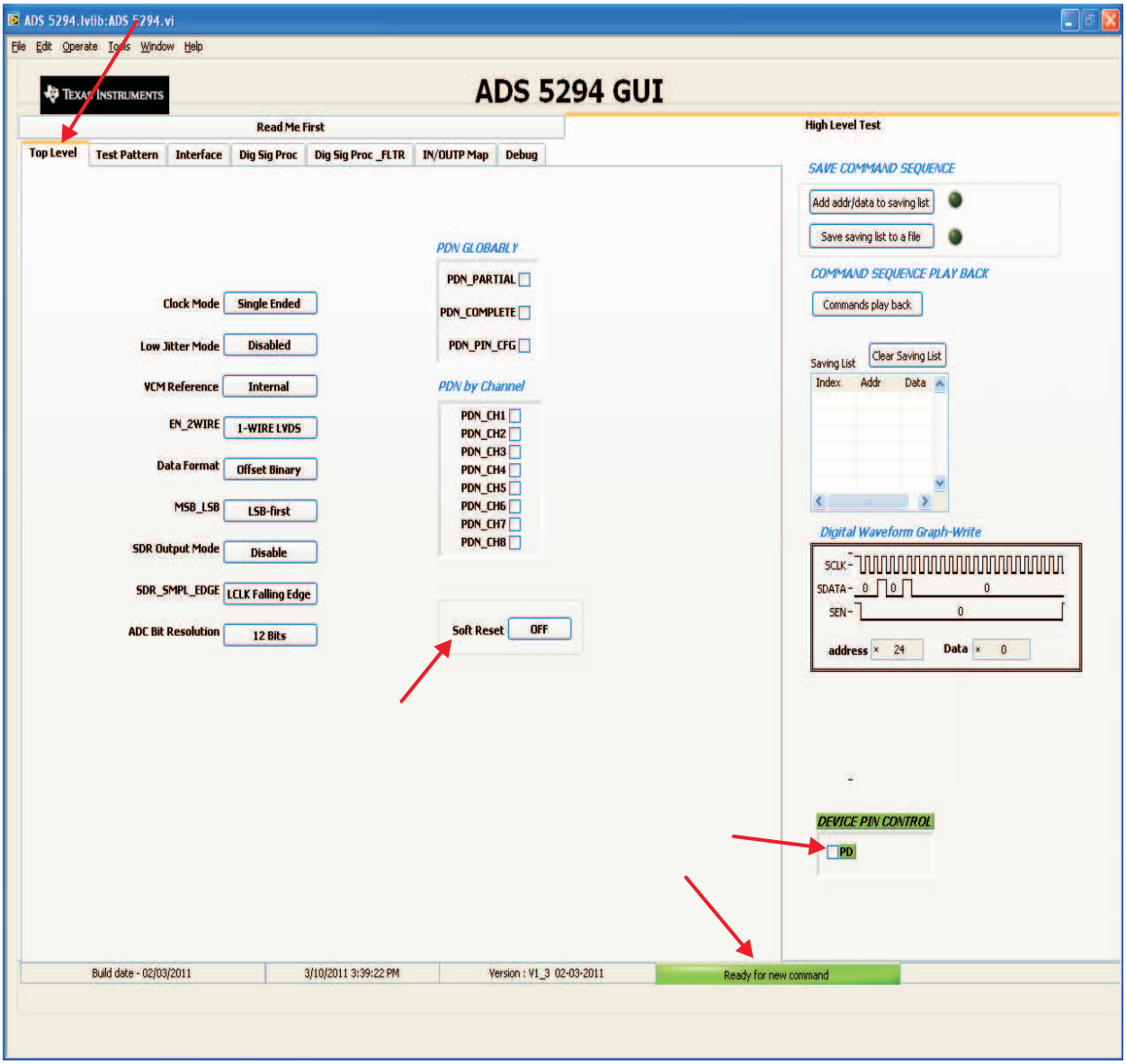
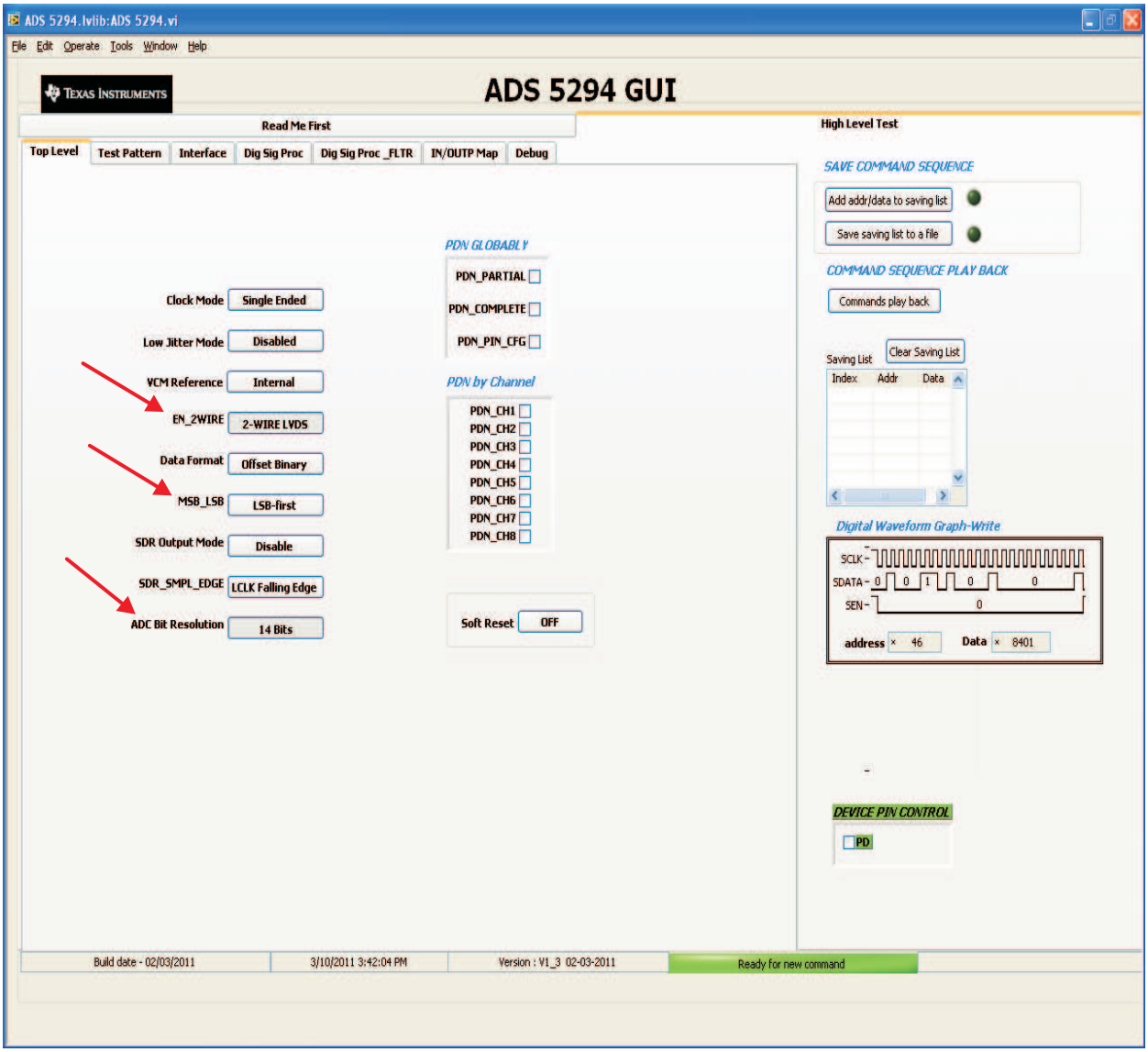


Figure 5. ADS5294 GUI Launch

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**.



7 Launch TSW1250 GUI

Launch TSW1250 GUI. The **Message** window displays this message to indicate that the setup of the TSW1250EVM 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. Select **LSB First** from **Data Caption Options** menu.
3. **ADC Sampling Rate (Fs)** is fixed at 80 MHz; this is the onboard CMOS clock frequency.
4. **ADC Input Frequency** – enter 5M and the GUI calculates the real coherent frequency (Fc) to 4.98535156M.

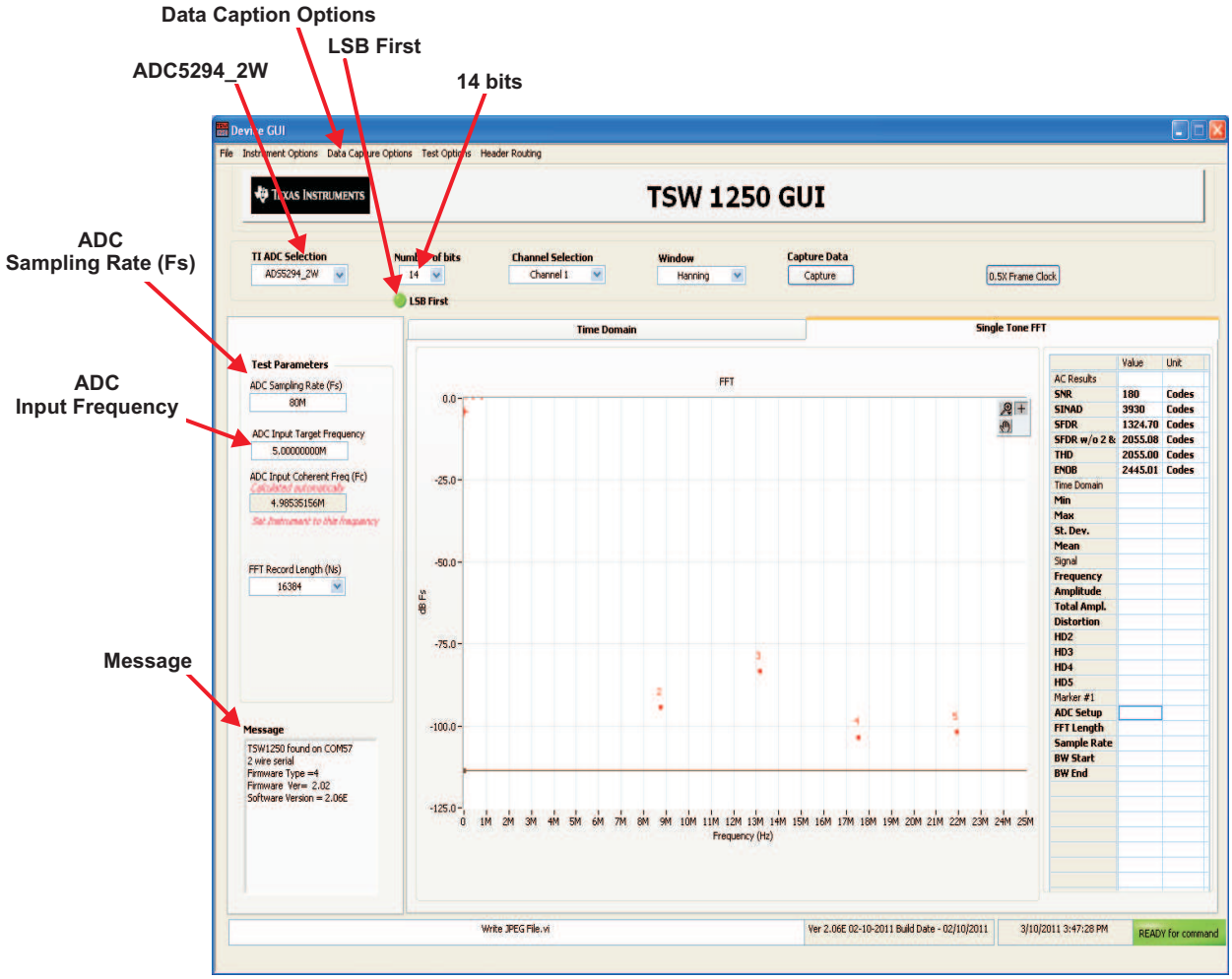


Figure 6. TSW1250 GUI Launch

8 TEST ADS5294

8.1 Step 1: Time Domain

- Select **Time Domain** page from TSW1250 GUI.
- Uncheck **Overlay unwrap waveform**.

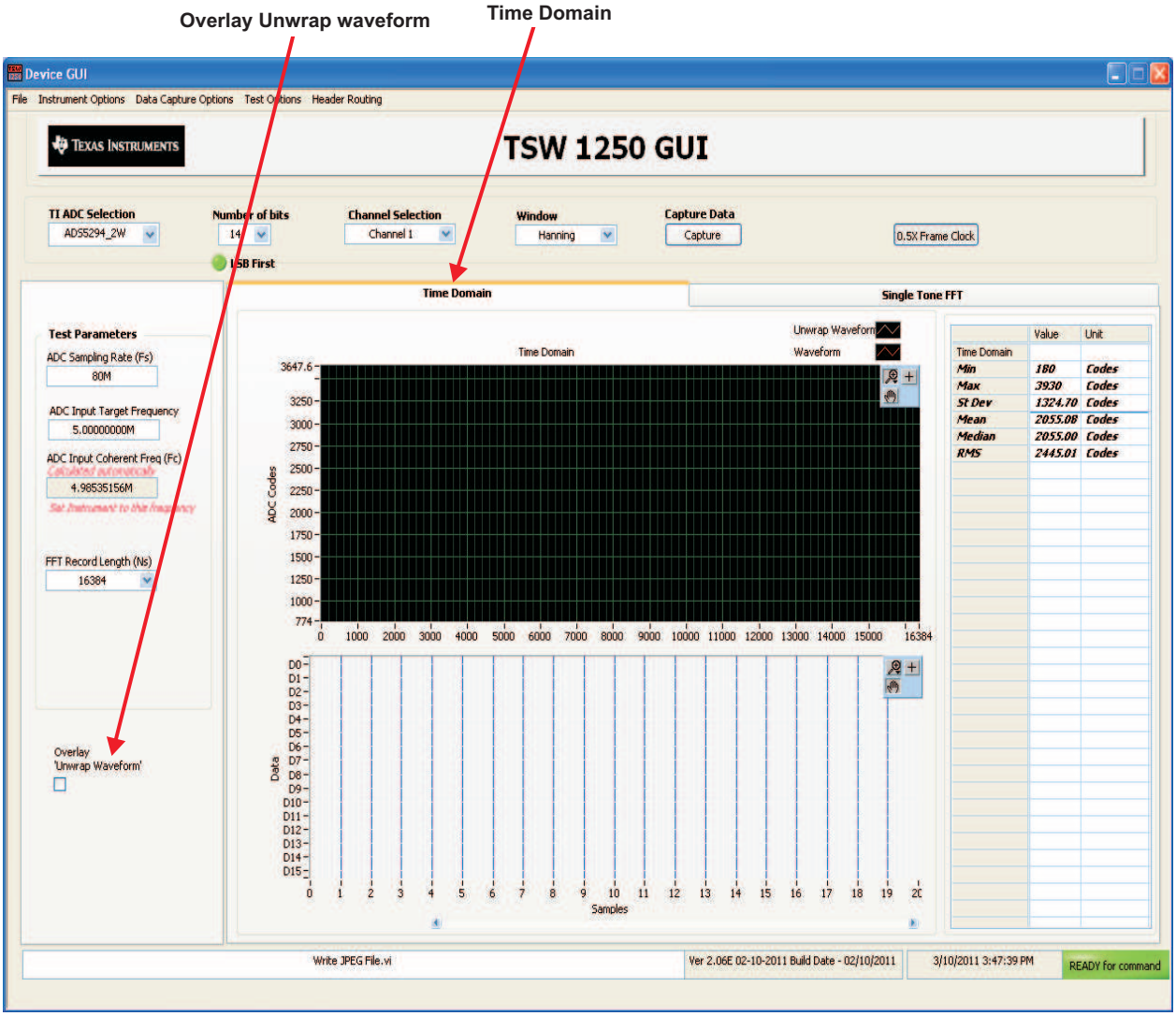


Figure 7. ADS5294 Time Domain Setup

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

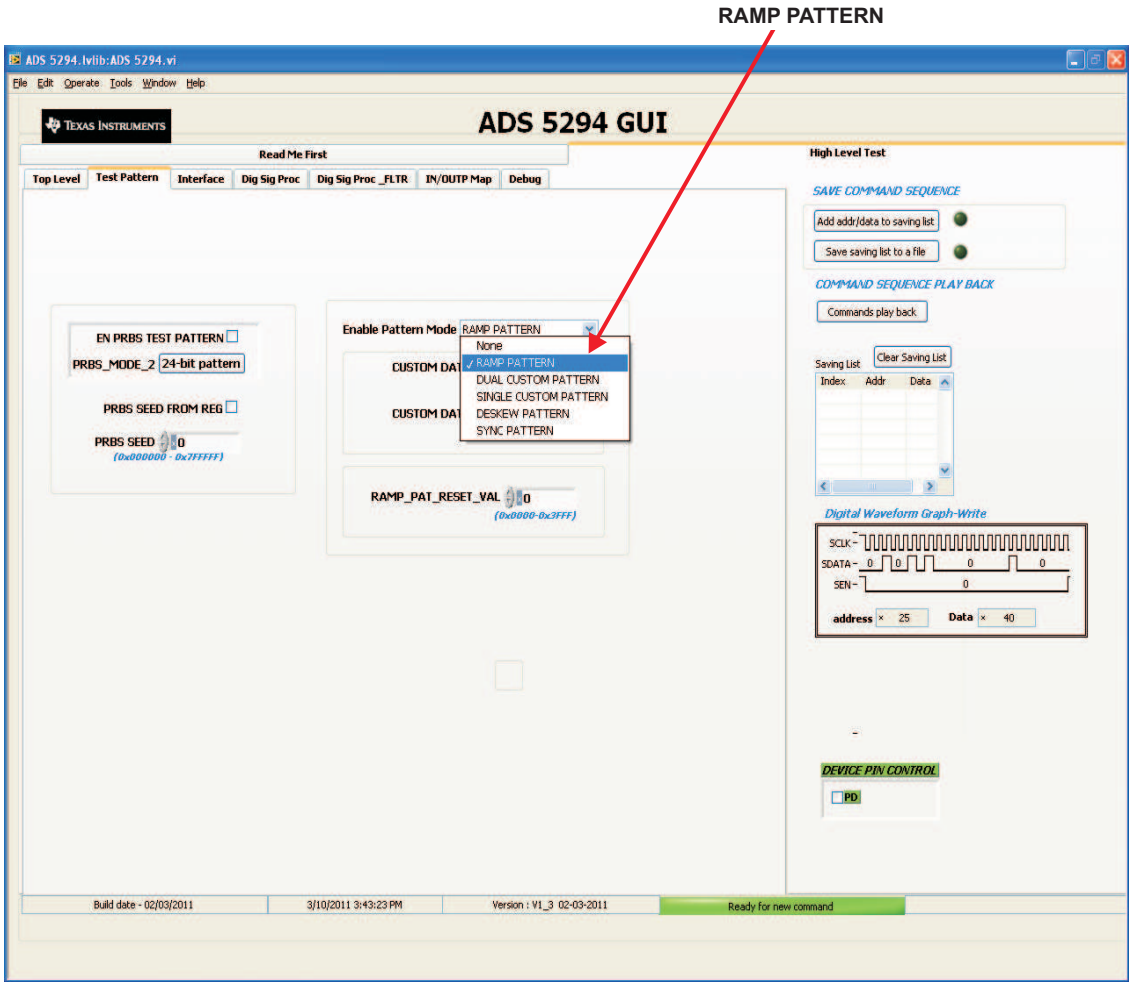


Figure 8. ADS5294 Test Pattern

- Press Capture button on TSW1250 GUI. You observe a ramping waveform on the TSW1250 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.

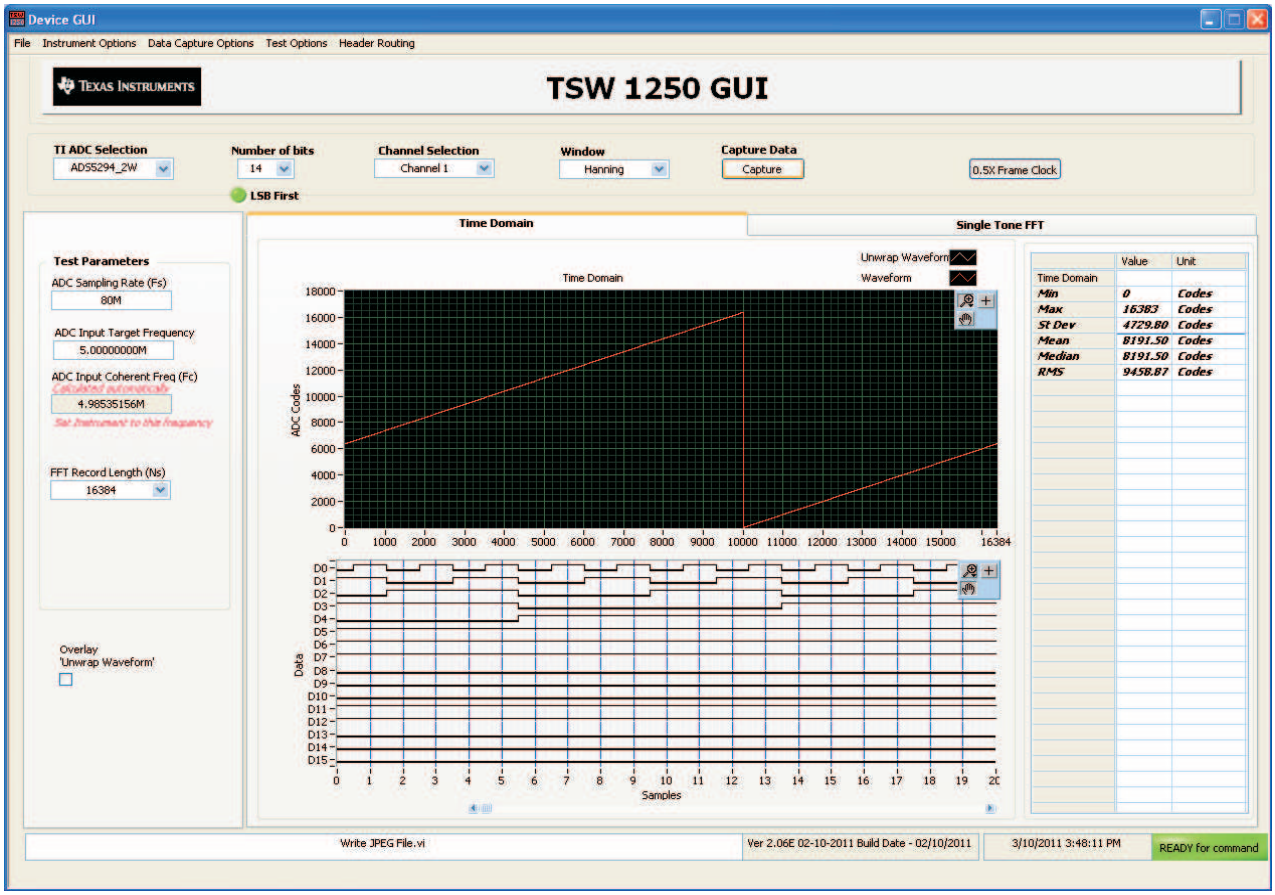
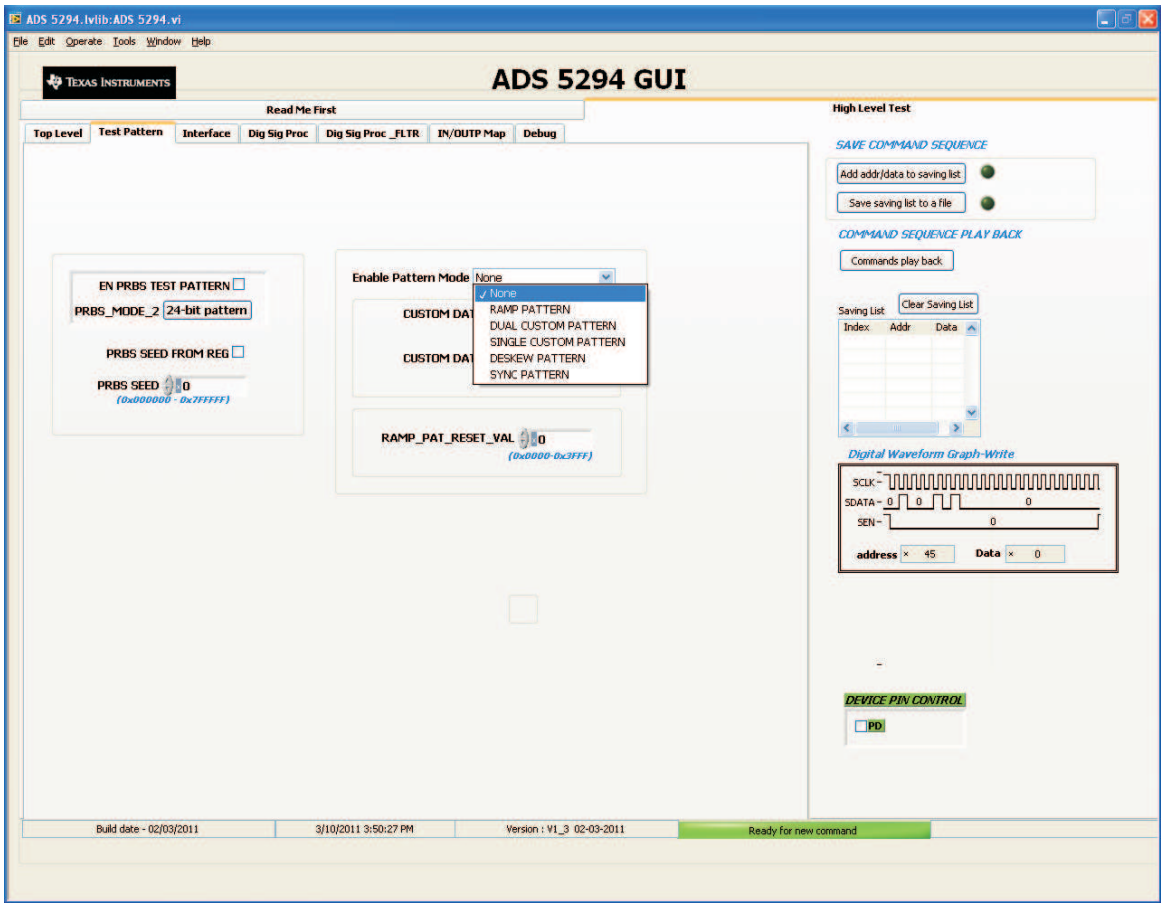


Figure 9. User Interface: Time Domain Format



8.2 Step 2: Single Tone FFT

- Select **Single Tone FFT** page at TSW1250 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 **4.98535156M** 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.

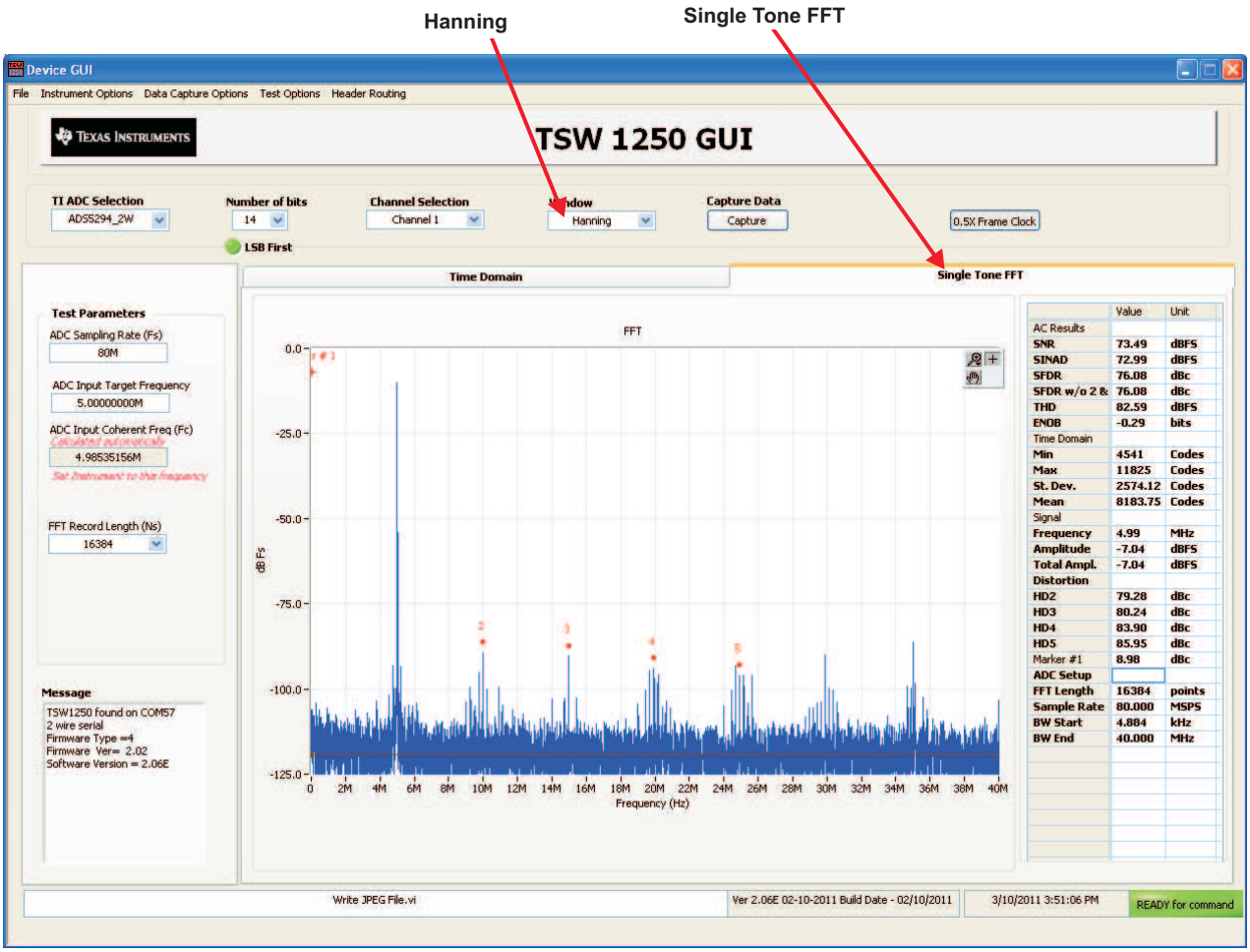


Figure 10. User Interface: Single FFT Format

9 Board Configuration

9.1 Input/Output, Power Supply, and USB

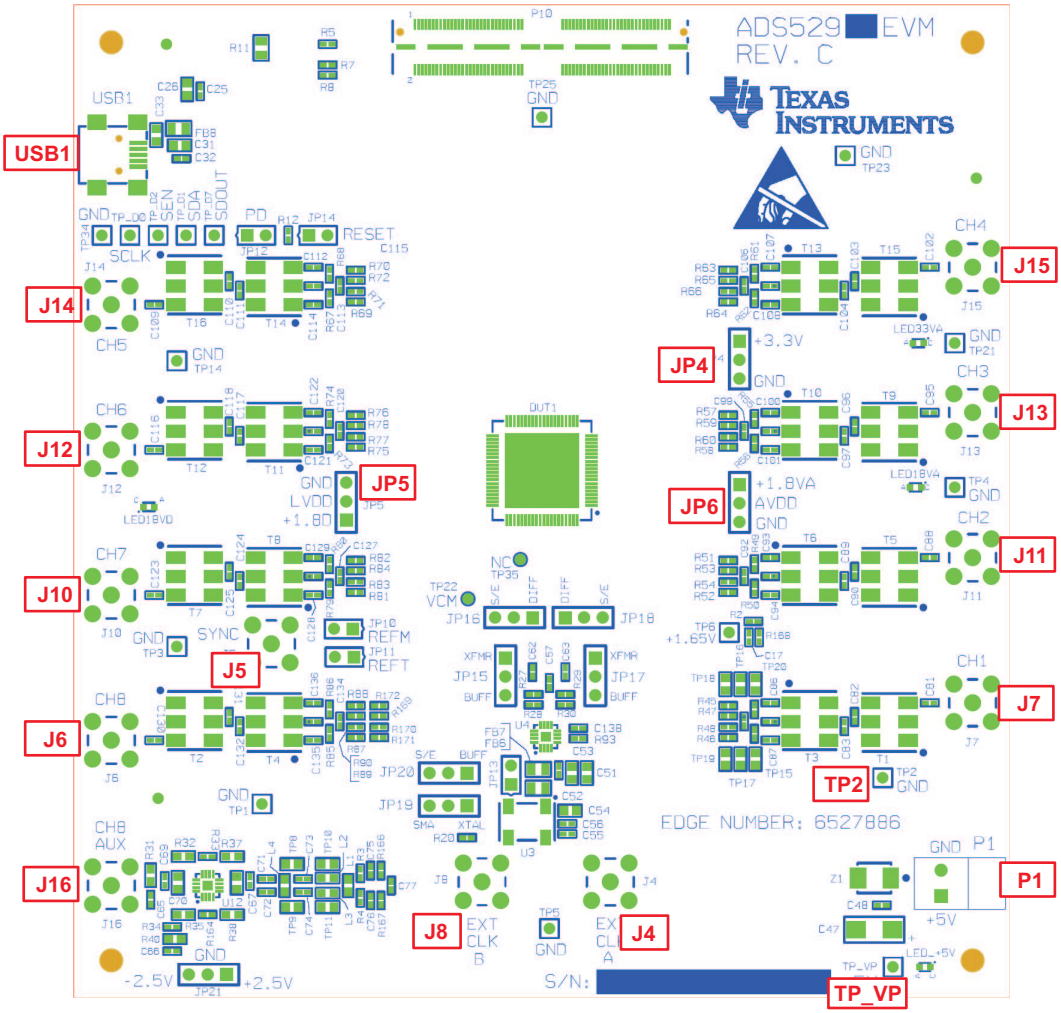


Figure 11. I/O, PWR, and USB Connector

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.

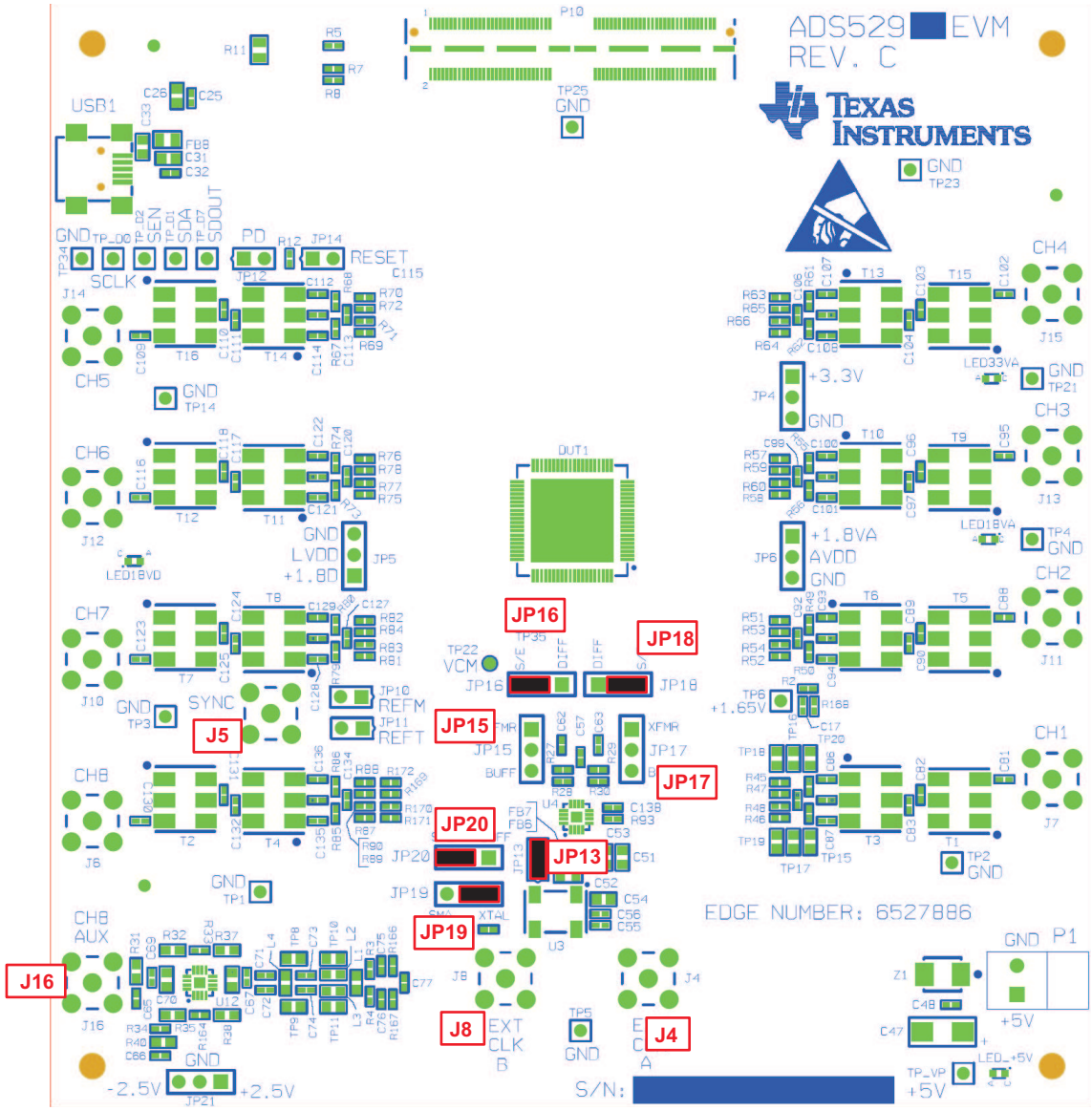


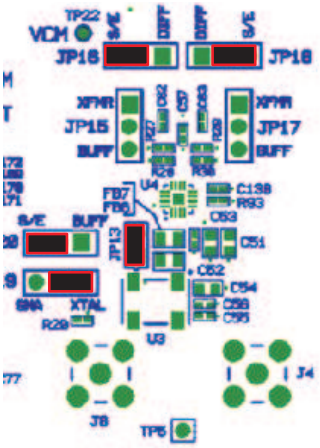
Figure 12. ADS5294EVM Default Clock Jumper Locations

Table 3. ADC Clock Various Mode Jumper Settings

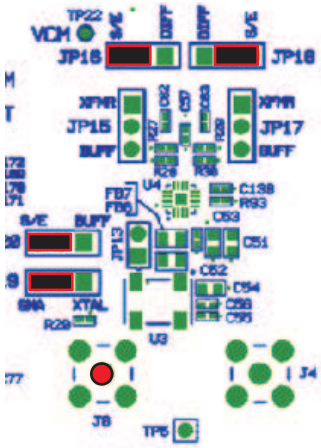
Clock Type		Reference Designator	Jumper Setting	Diagram
Single Ended	Onboard CMOS Oscillator	JP13, JP19, JP20, JP16, JP18	JP13 (1-2), JP20 (2-3), JP19 (1-2), JP16 (2-3), JP18 (2-3)	Dia. 1 (Default Option)
	External CMOS Clock Generator	J8, JP19, JP20, JP16, JP18	JP20 (2-3), JP19 (2-3), JP16 (2-3), JP18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

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

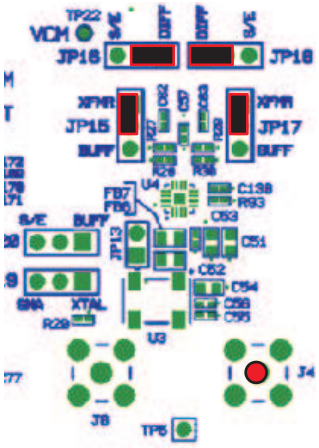
Clock Type		Reference Designator	Jumper Setting	Diagram
Differential Clock Signal	Transformer Based External	JP15, JP17, JP16, JP18, J4	JP15 (1-2), JP16 (1-2),JP17 (1-2), JP18 (1-2), and Connect external Clock source at SMA connector J4	Dia. 3
	Onboard Clock Buffer (CDCLVP1102,U4)	JP13, JP19, JP20, JP15, 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



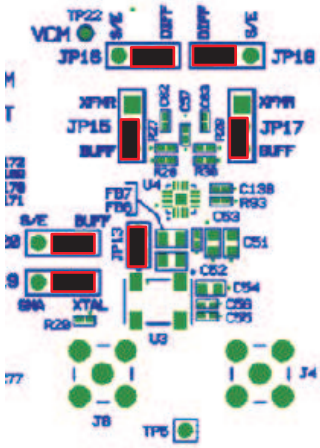
Dia.1



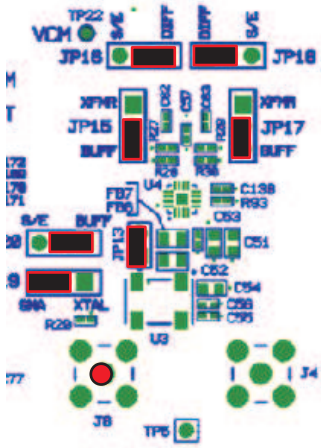
Dia.2



Dia.3



Dia.4



Dia.5

9.3 Light-Emitting Diodes

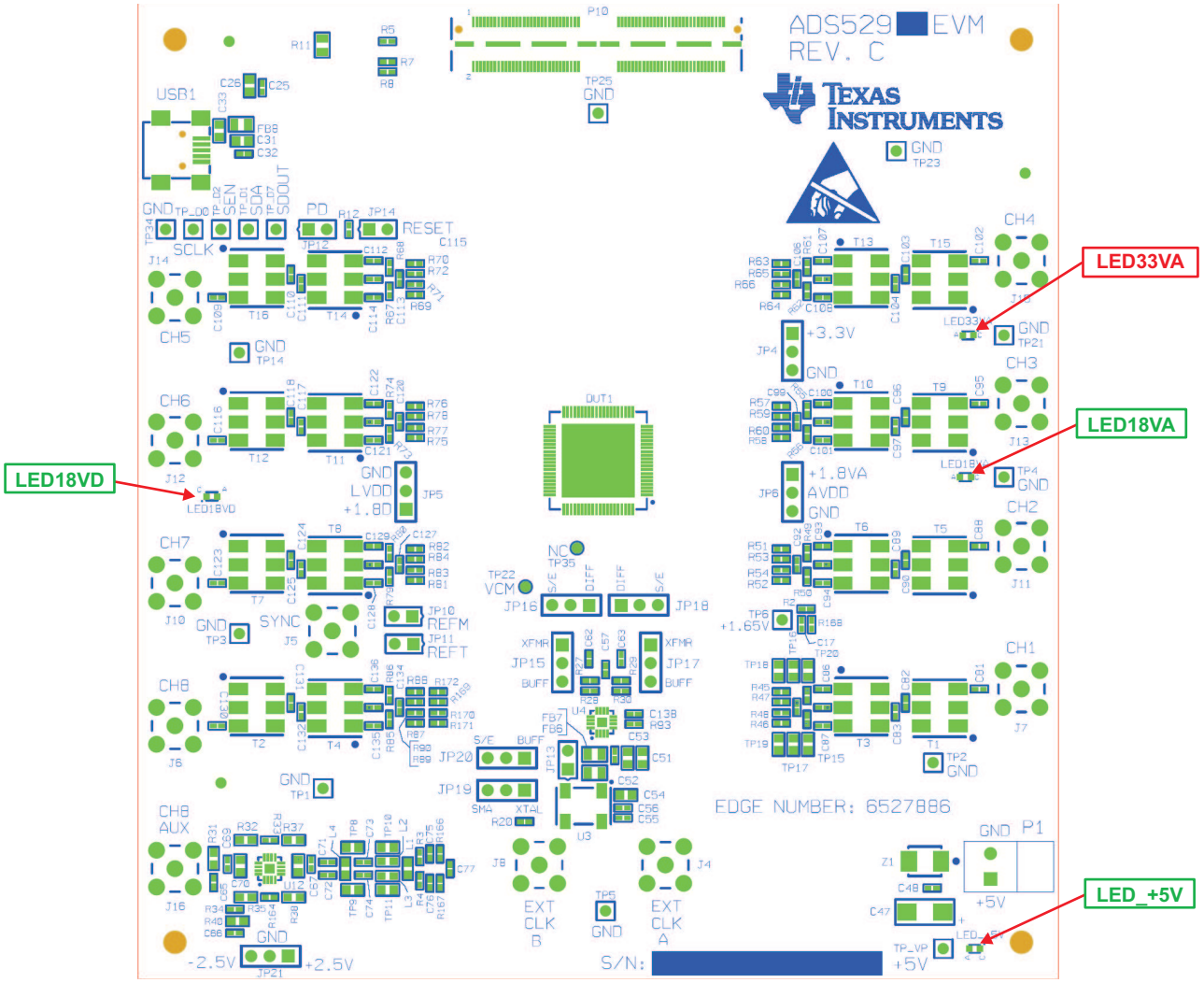


Figure 13. ADS5294EVM LED Location

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

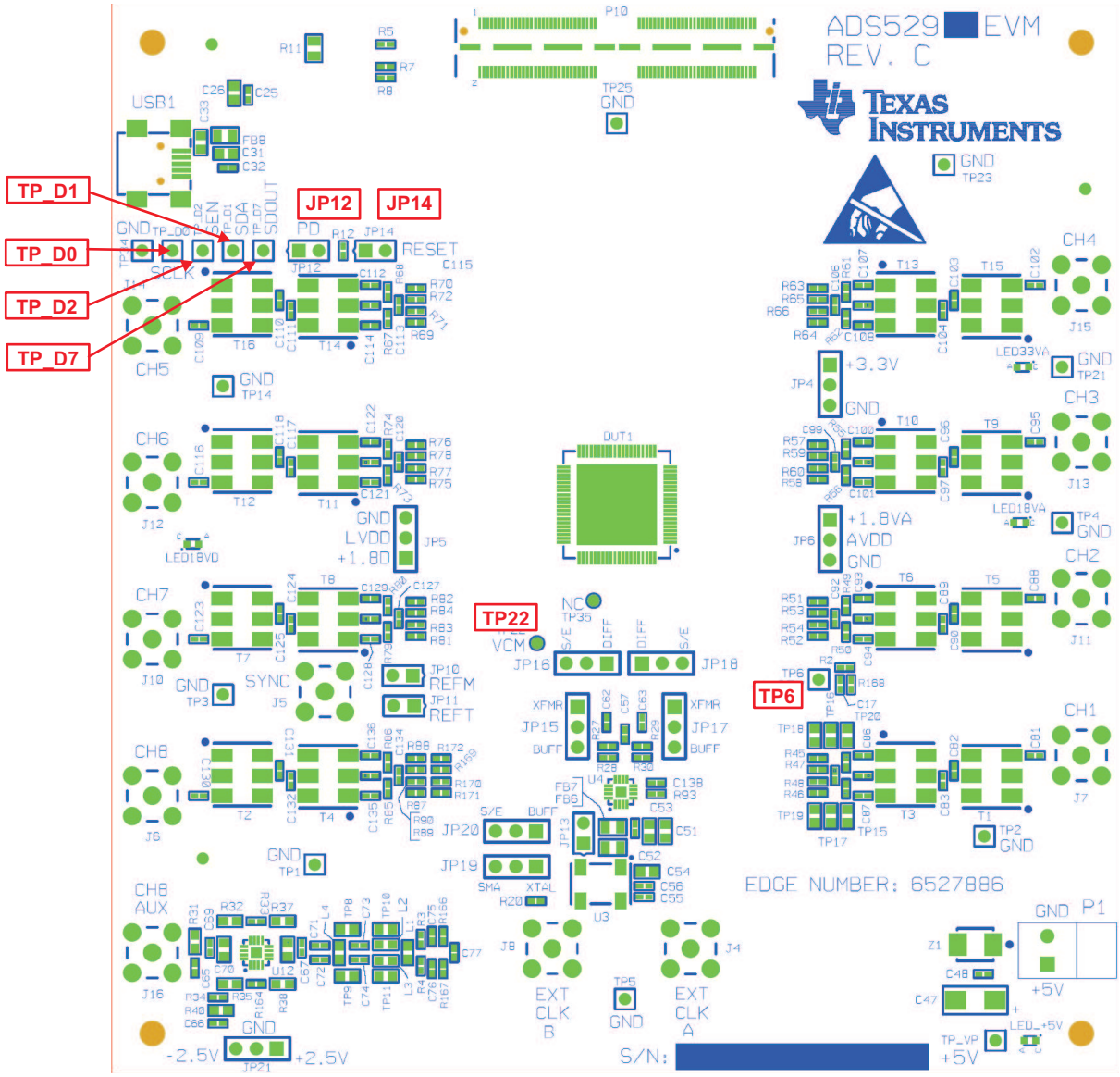


Figure 14. ADS5294EVM Test Point Locations

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

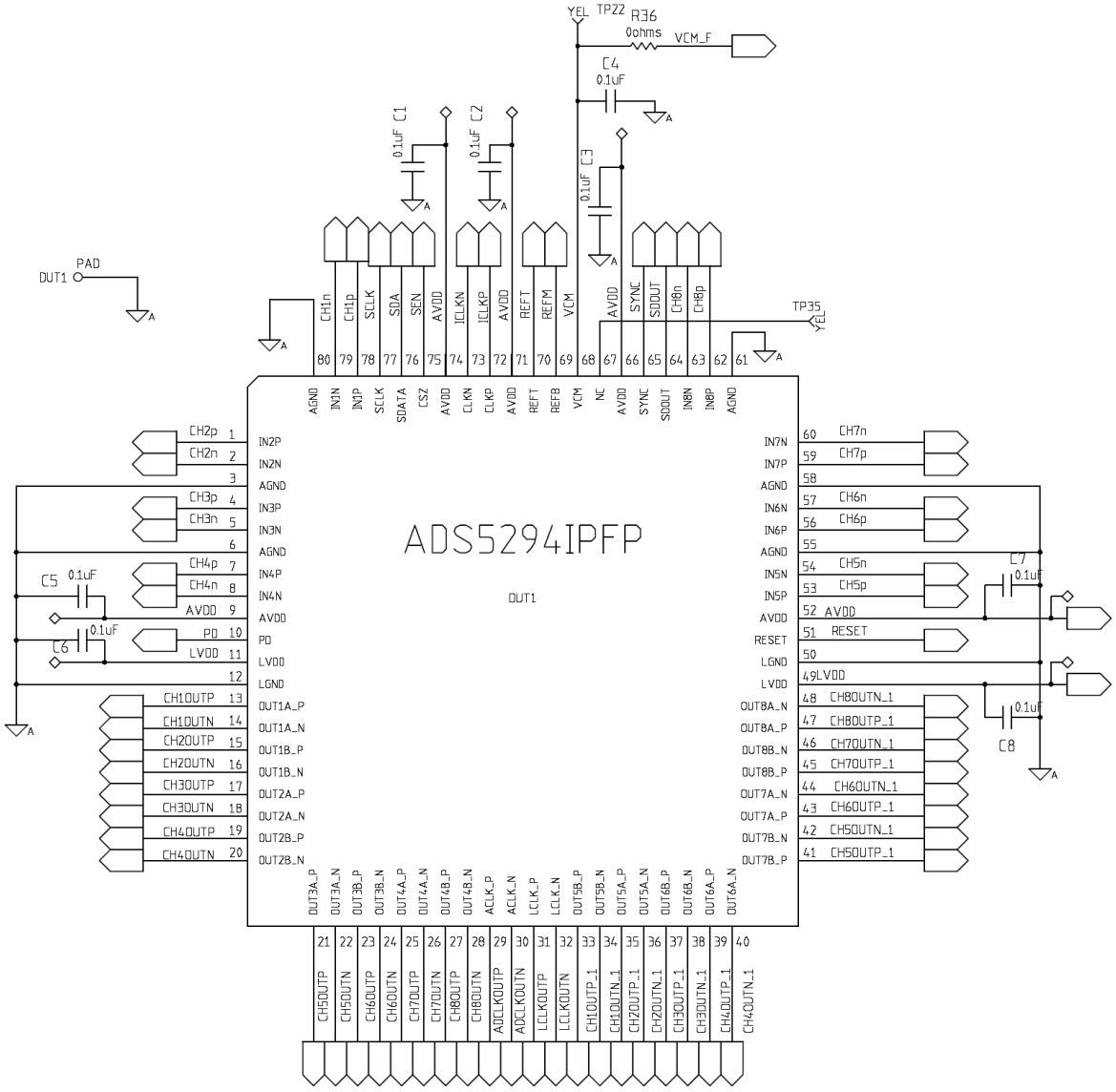


Figure 15. Schematic, Sheet 1 of 9

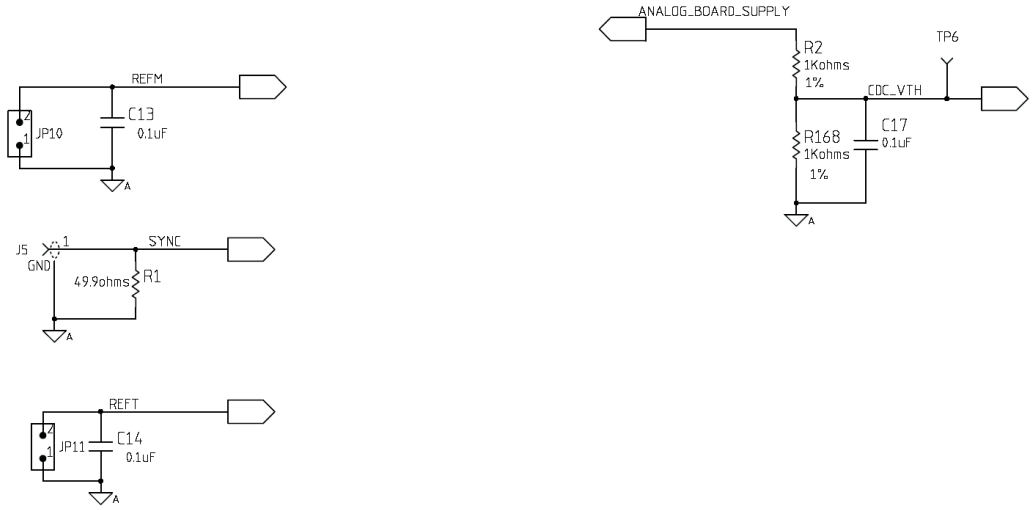


Figure 16. Schematic, Sheet 2 of 9

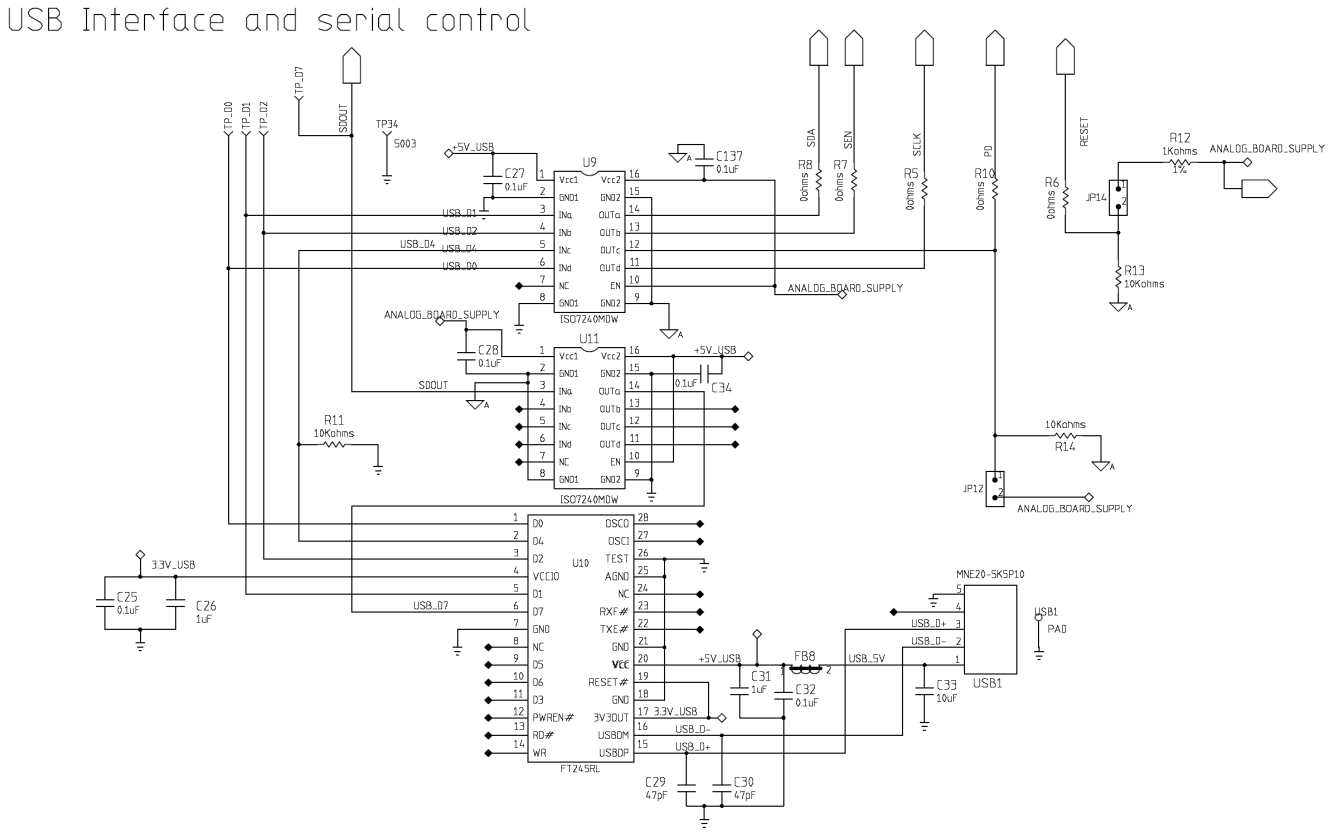


Figure 17. Schematic, Sheet 3 of 9

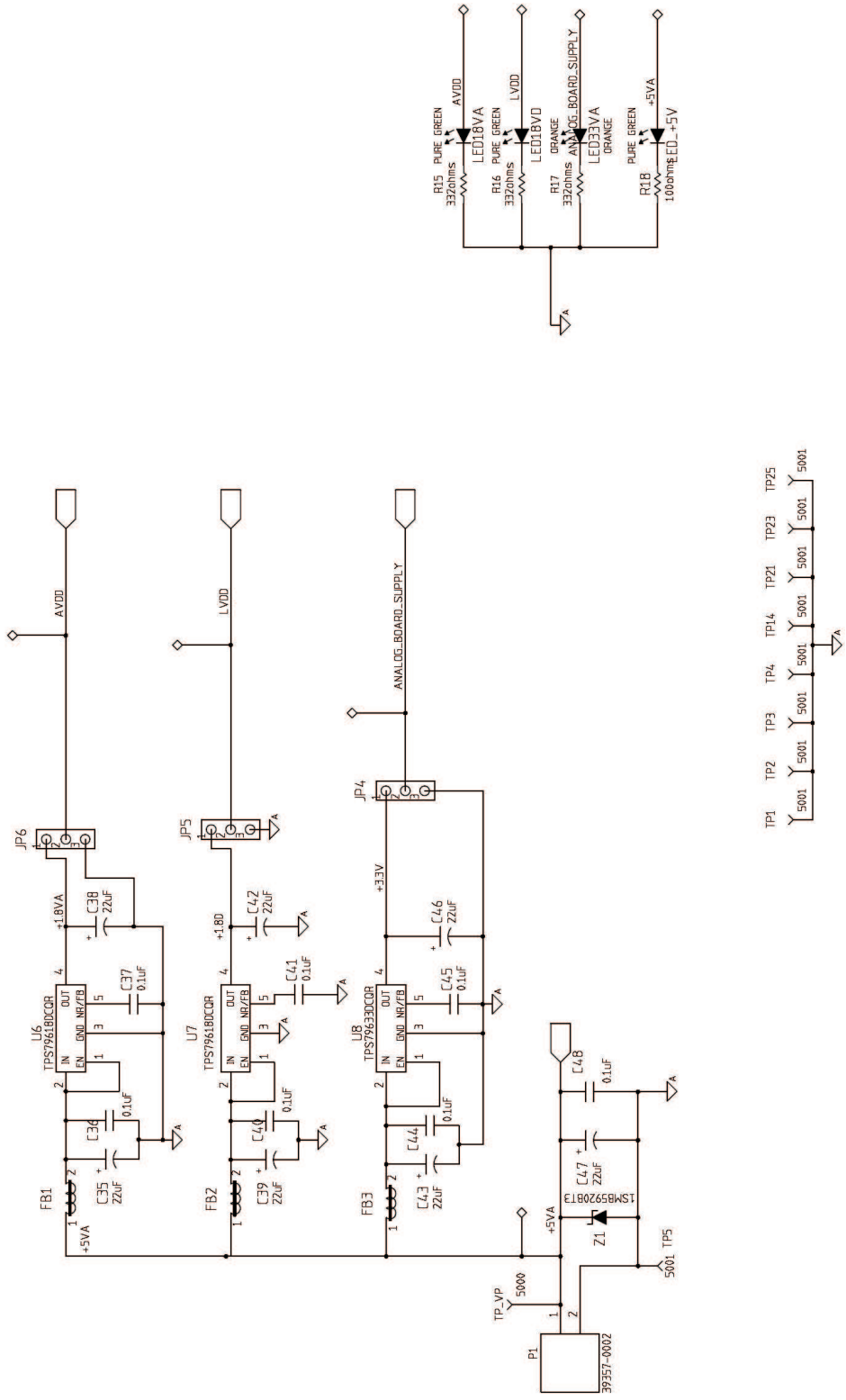


Figure 18. Schematic, Sheet 4 of 9

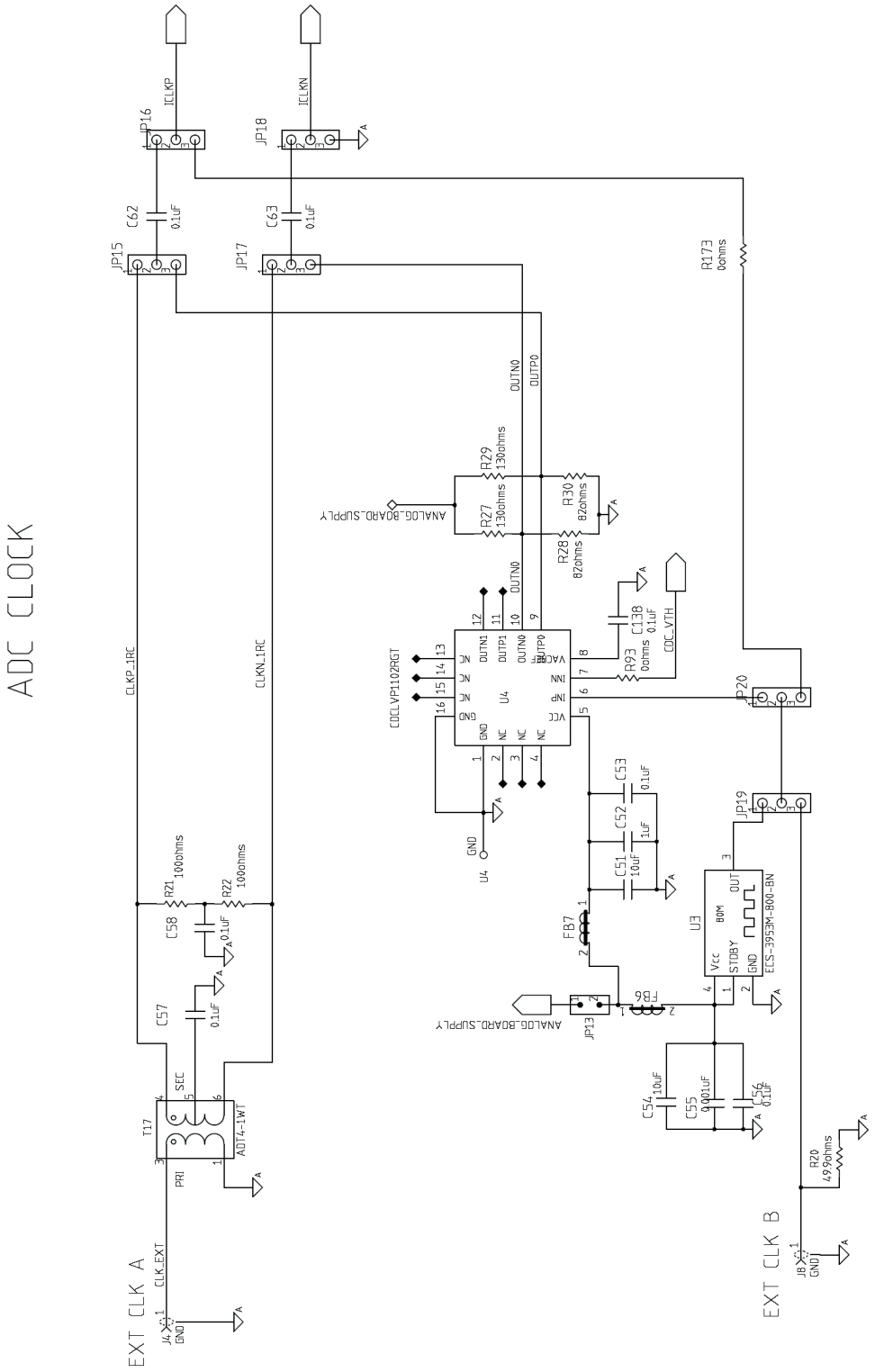


Figure 19. Schematic, Sheet 5 of 9

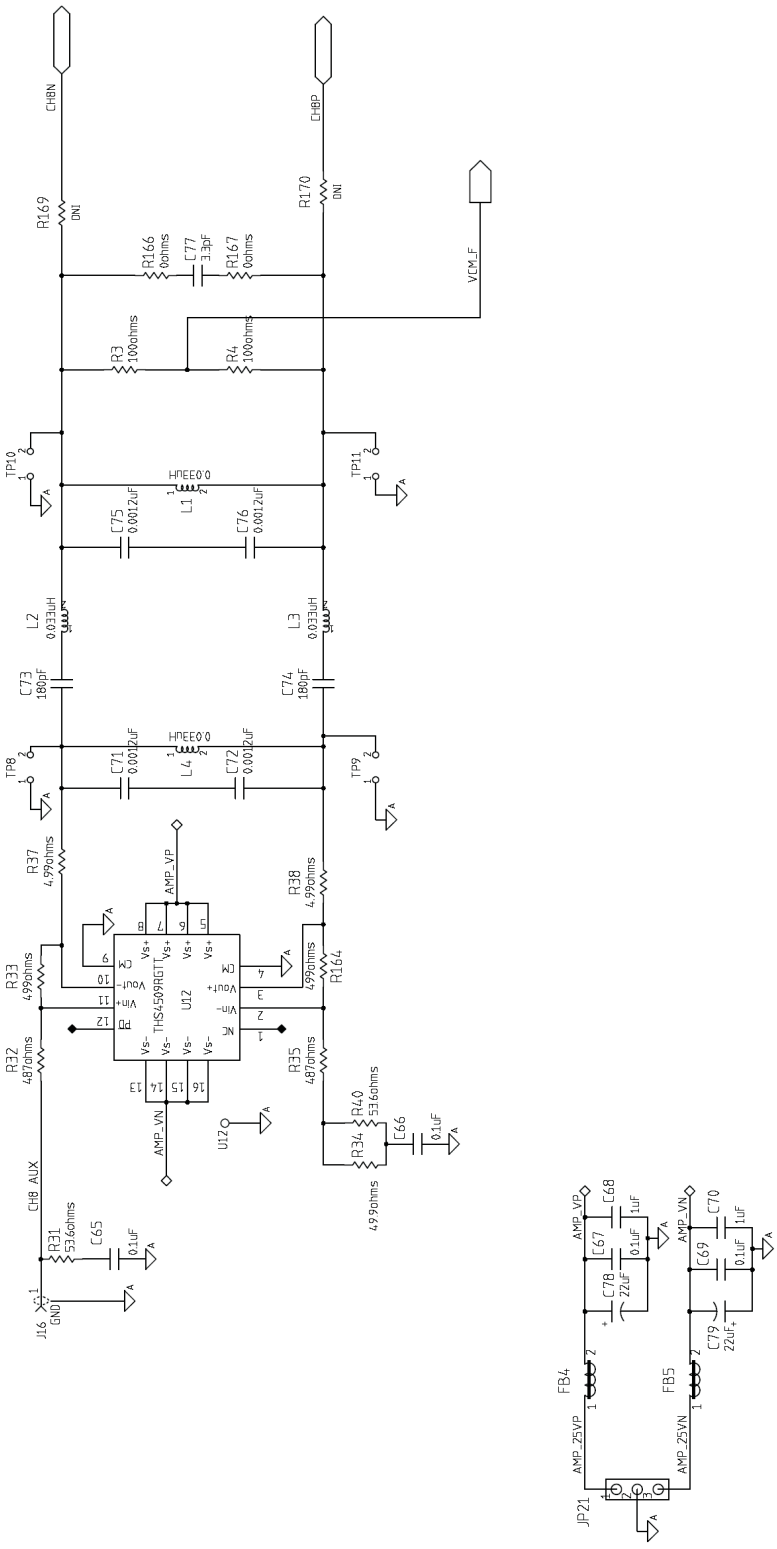


Figure 20. Schematic, Sheet 6 of 9

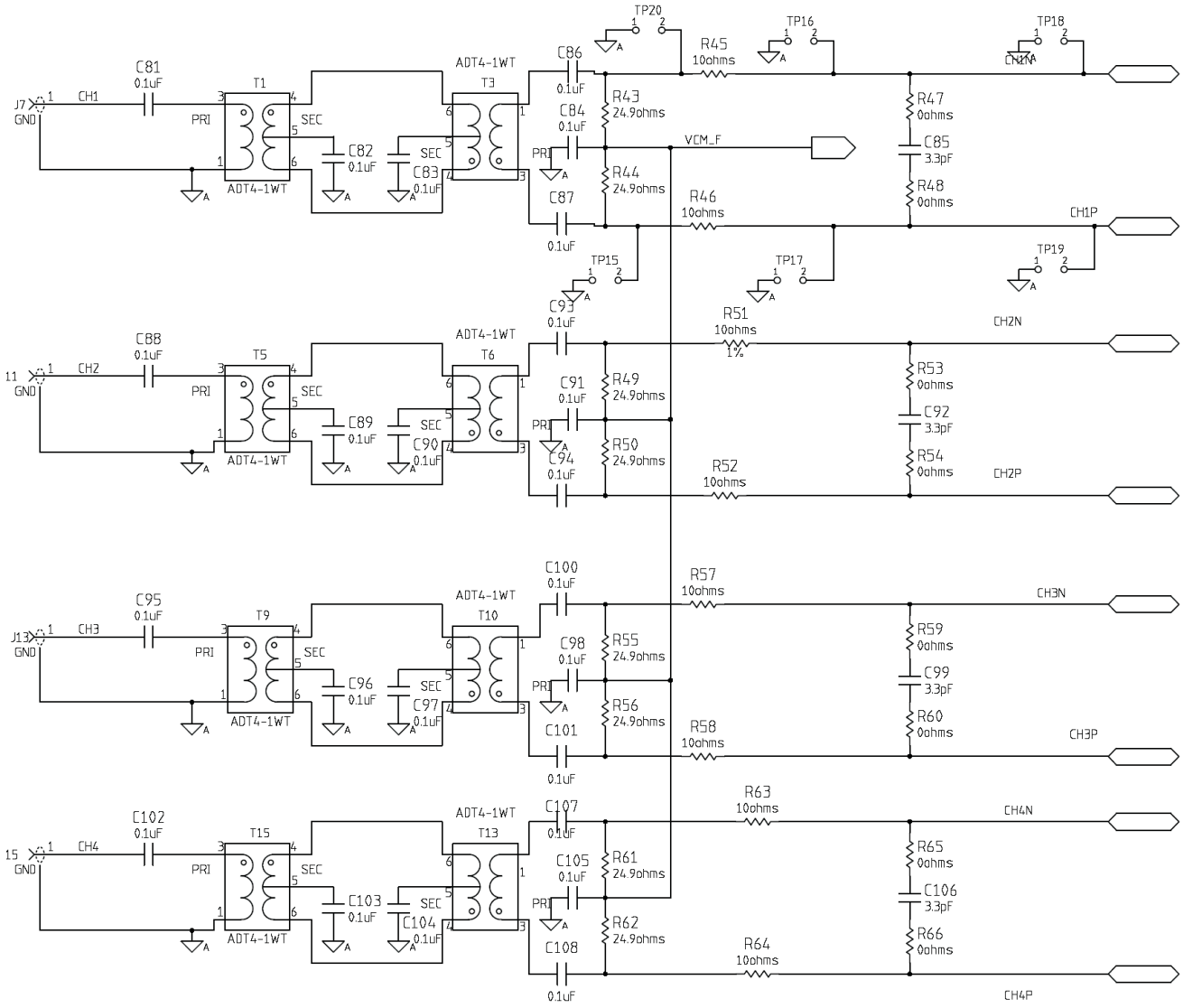


Figure 21. Schematic, Sheet 7 of 9

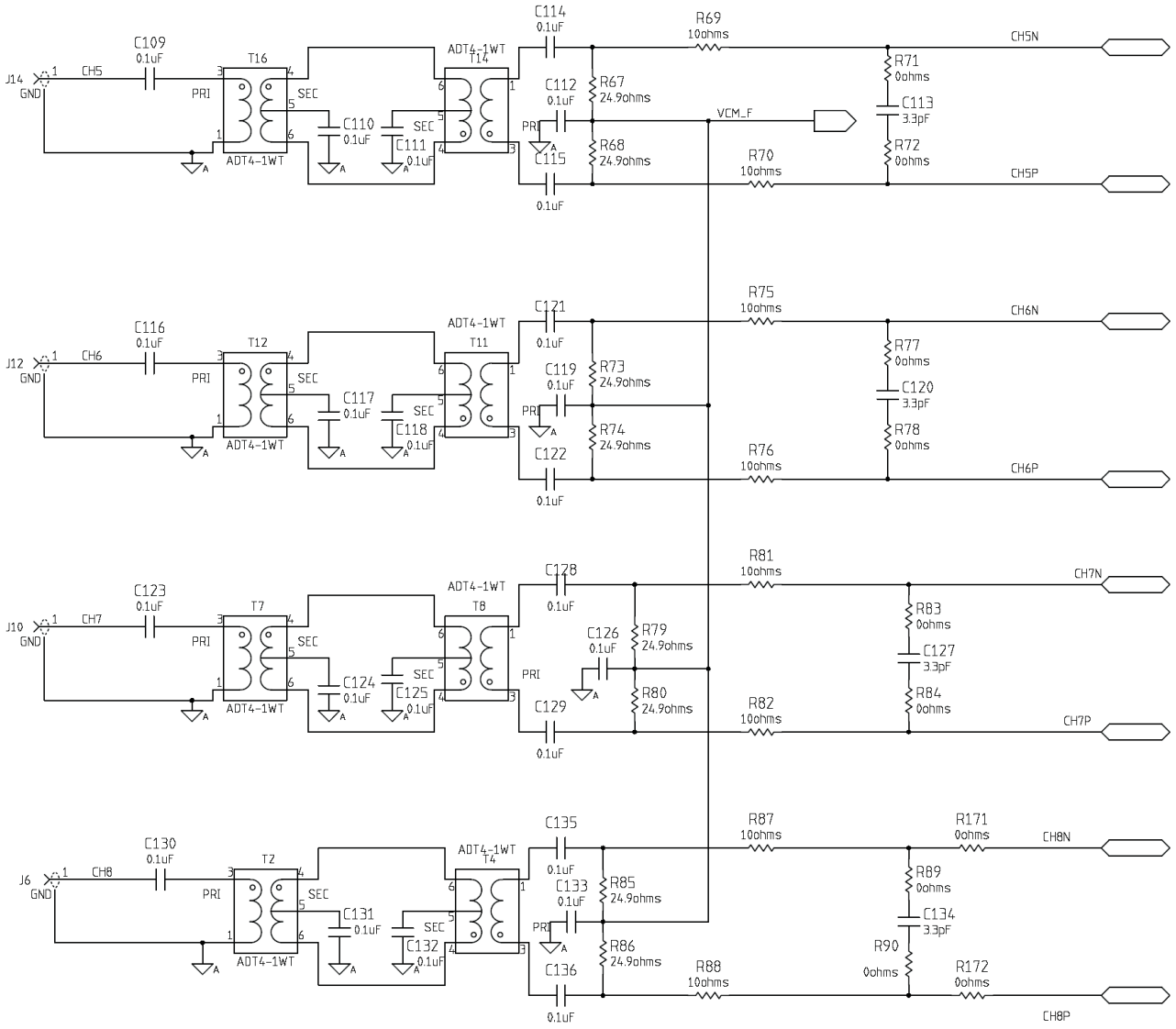


Figure 22. Schematic, Sheet 8 of 9

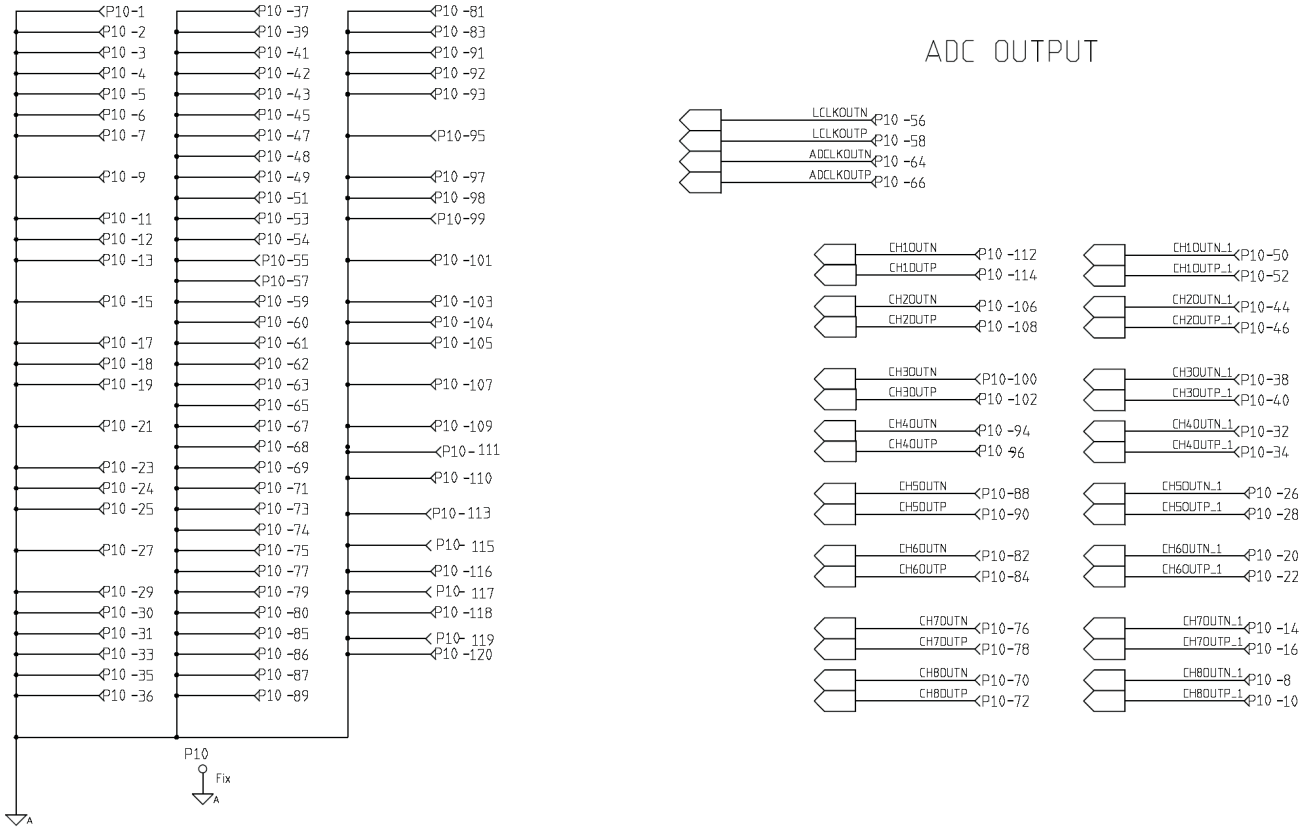


Figure 23. Schematic, Sheet 9 of 9

11 ADS5294EVM Bill of Materials

Table 6. 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

Table 6. 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

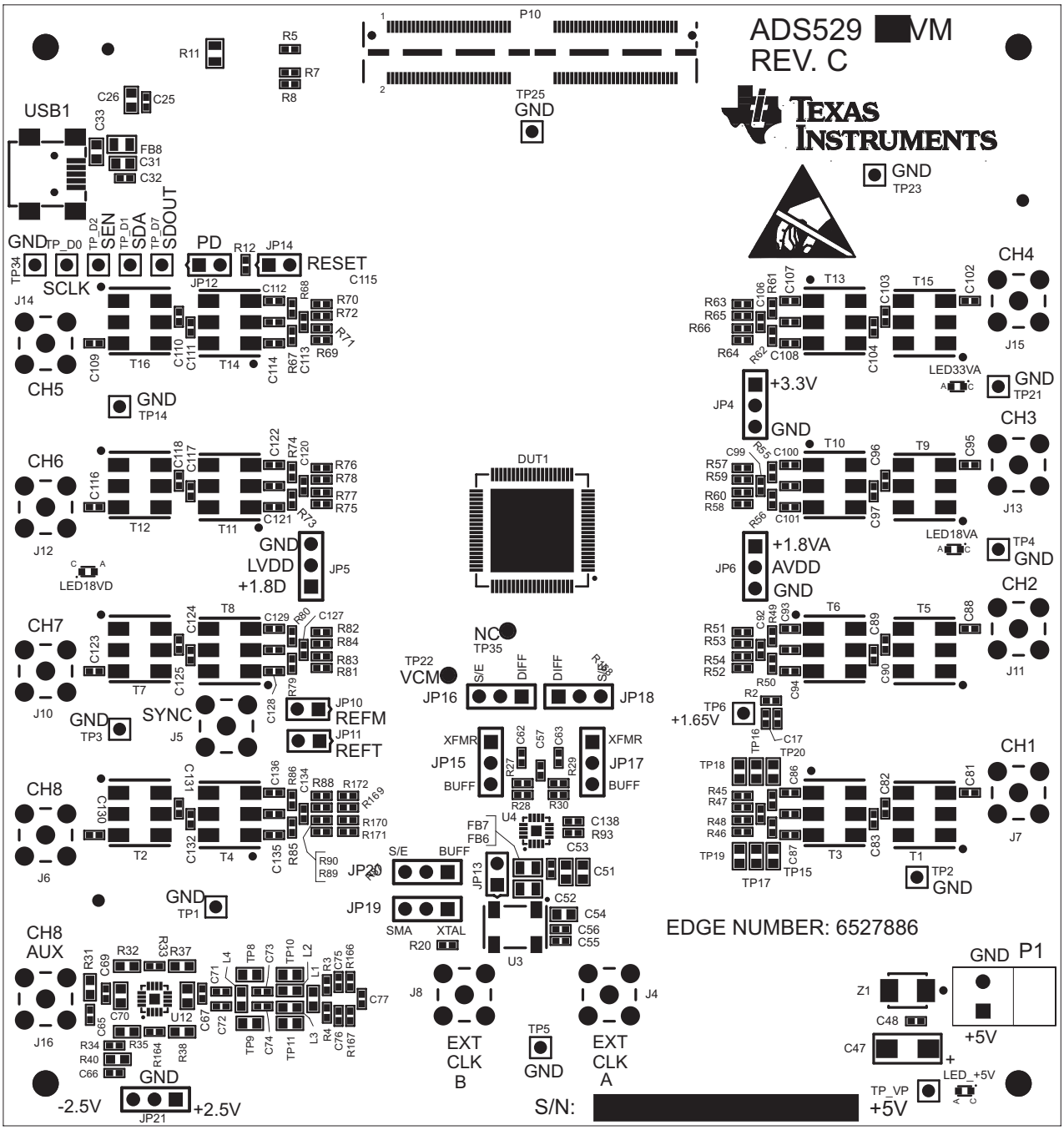


Figure 24. ADS5294EVM Top Layer Assembly Drawing – Top View

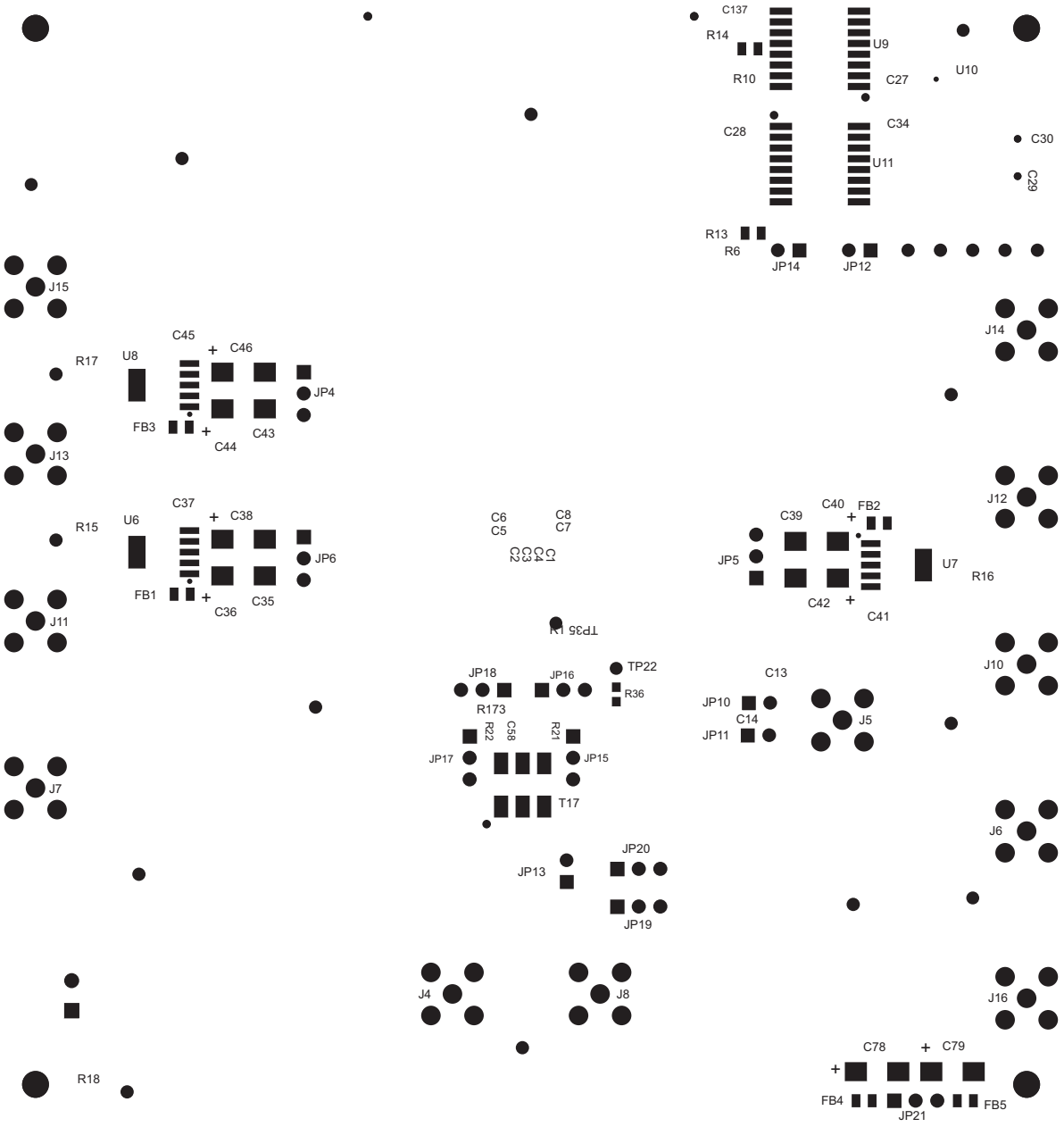


Figure 25. ADS5294EVM Bottom Layer Assembly Drawing – Bottom View

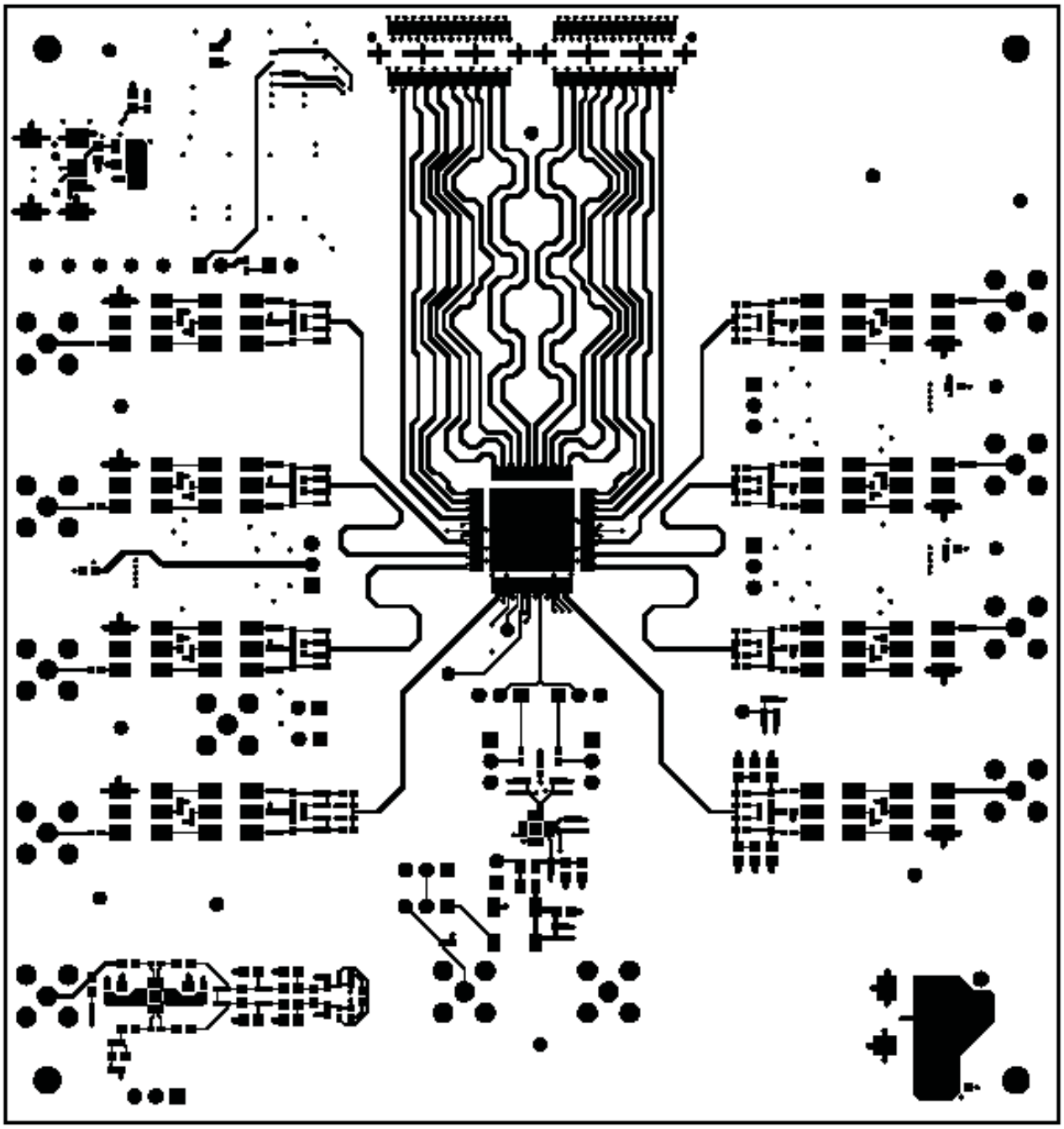


Figure 26. ADS5294EVM Top Layer Copper – Top View

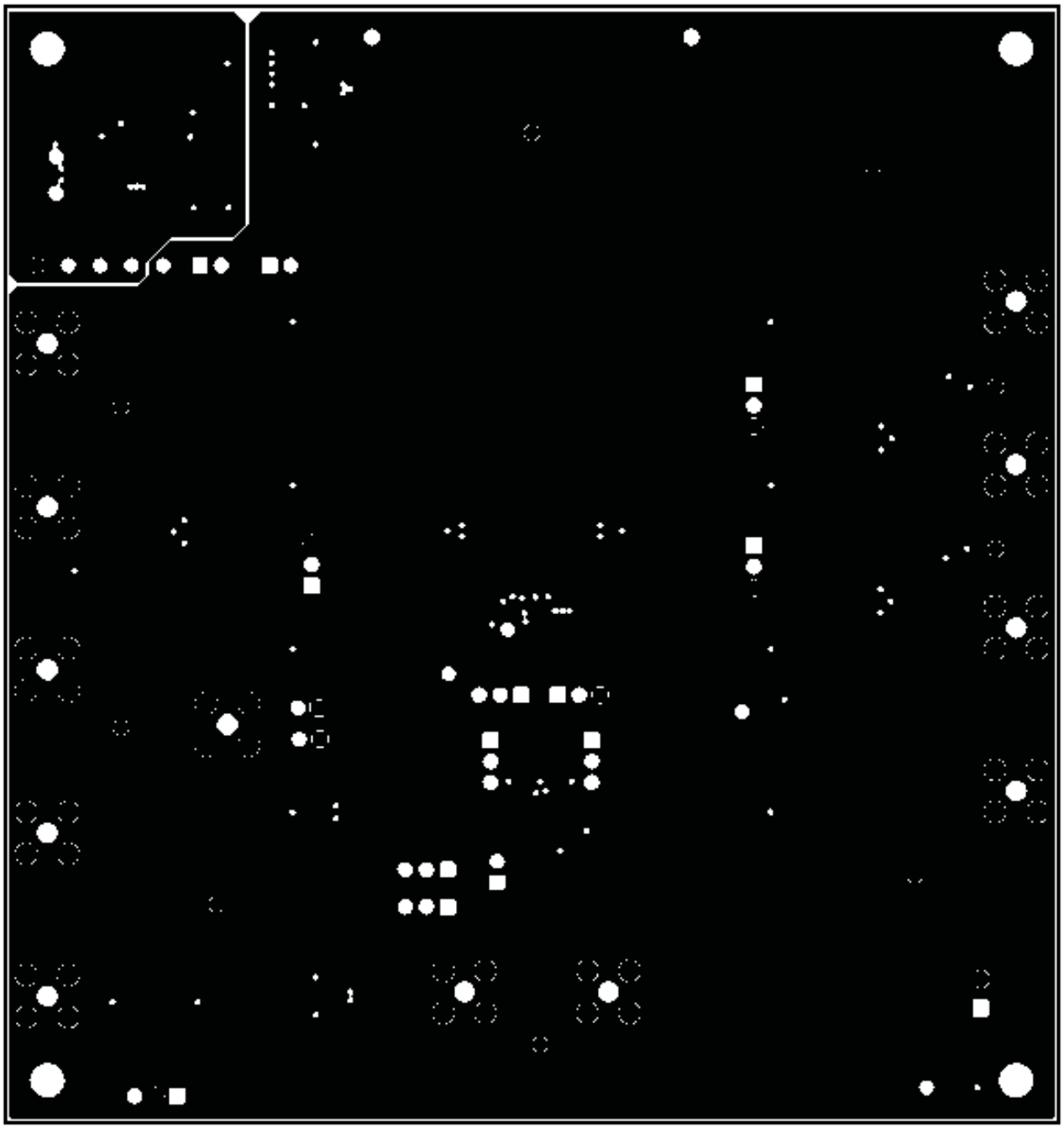


Figure 27. ADS5294EVM Internal Layer 1, Ground – Top View

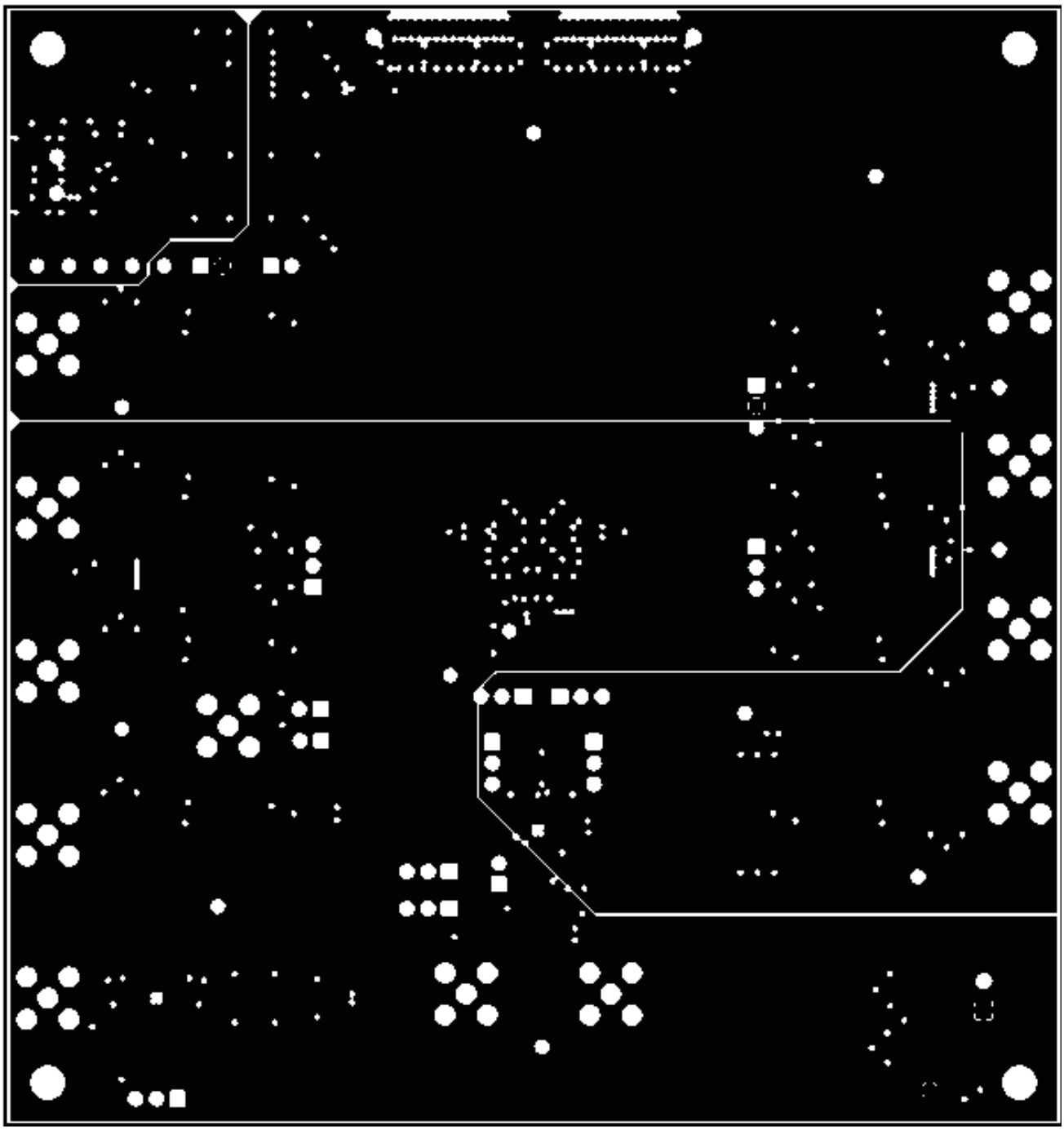


Figure 28. ADS5294EVM Internal Layer 2, Power – Top View

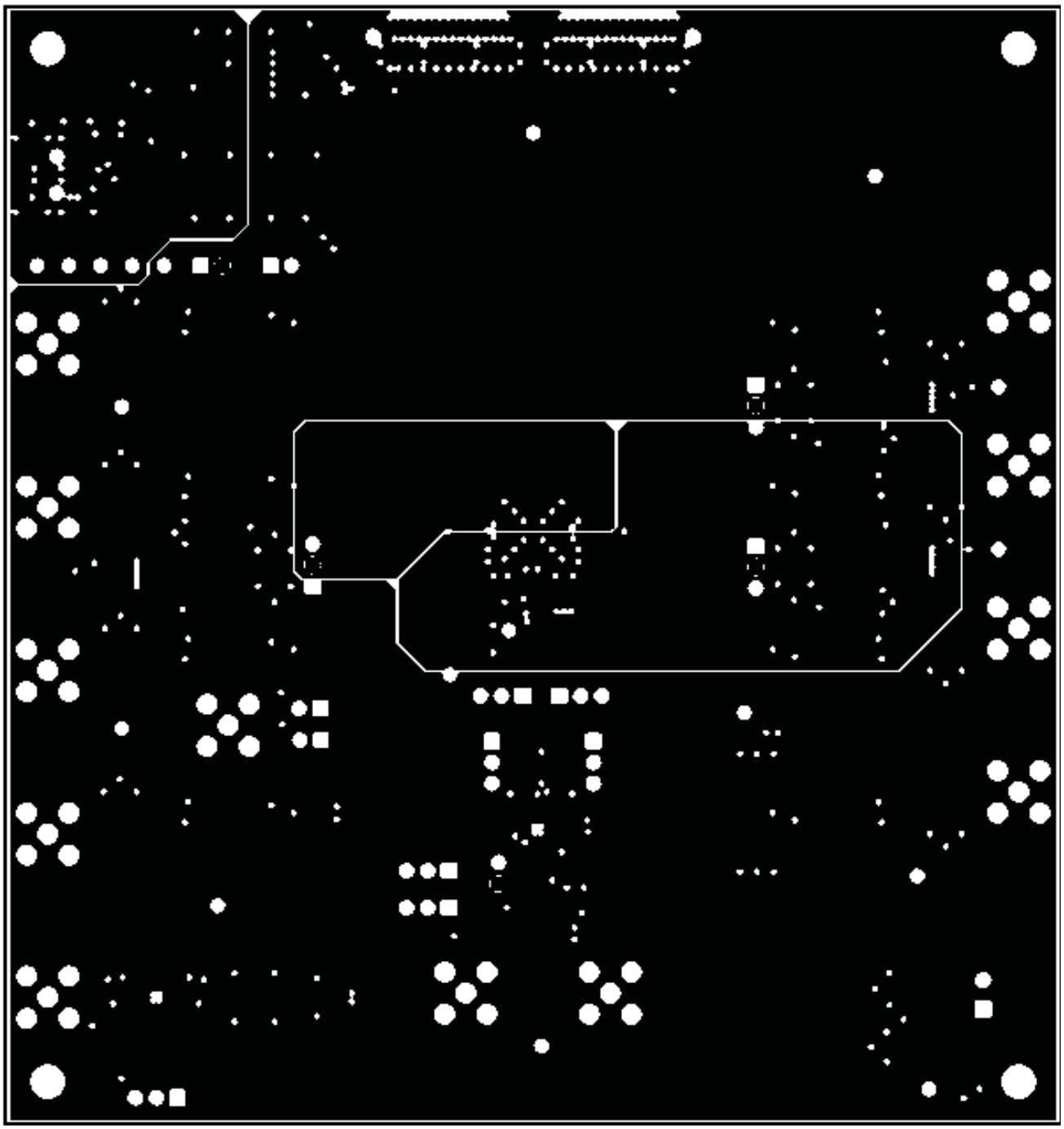


Figure 29. ADS5294EVM Internal Layer 3, Power – Top View

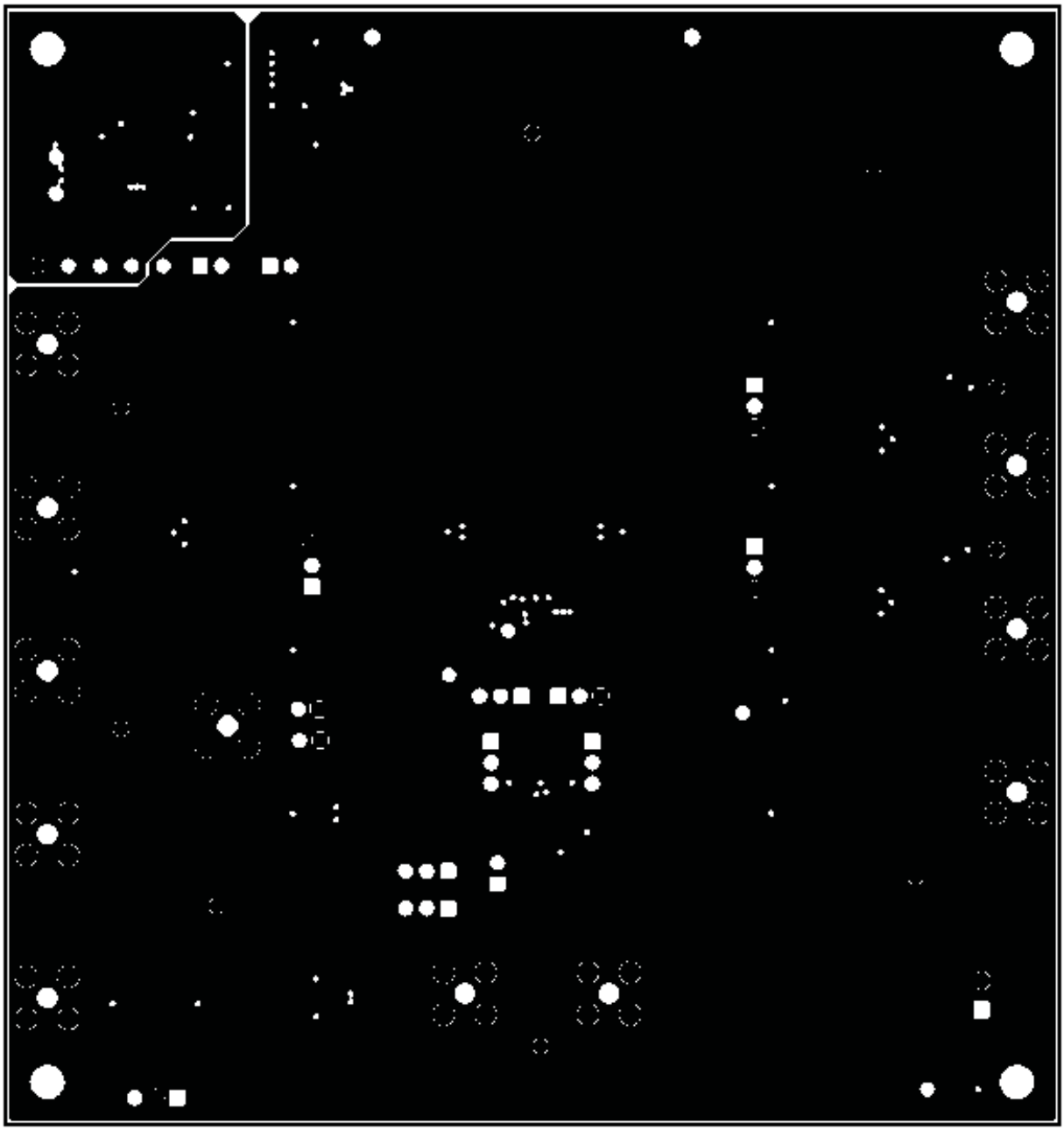


Figure 30. ADS5294EVM Internal Layer 4, Ground – Top View

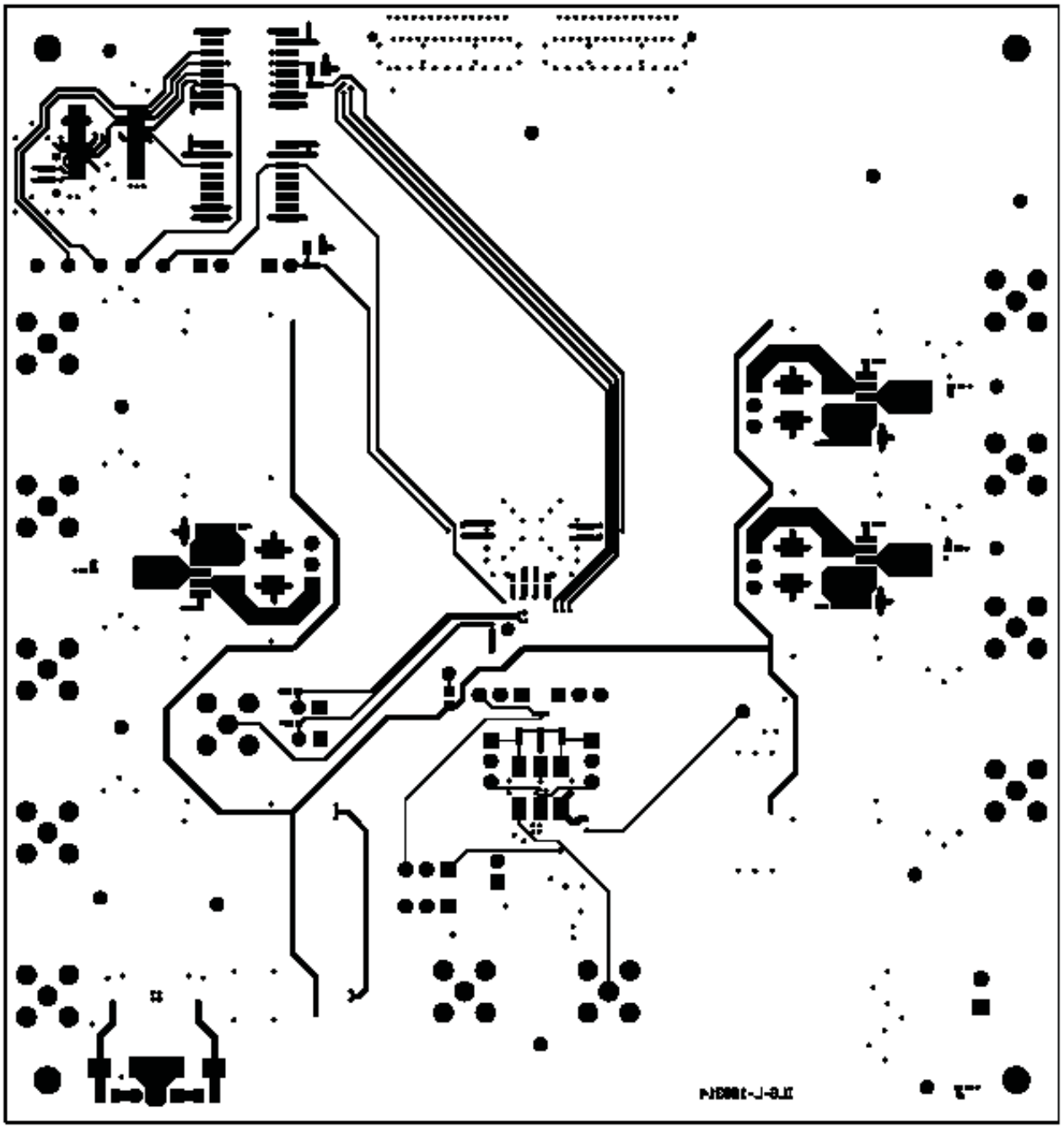


Figure 31. ADS5294EVM Bottom Layer Copper – Top View

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

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 25°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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