

ADS127L01EVM

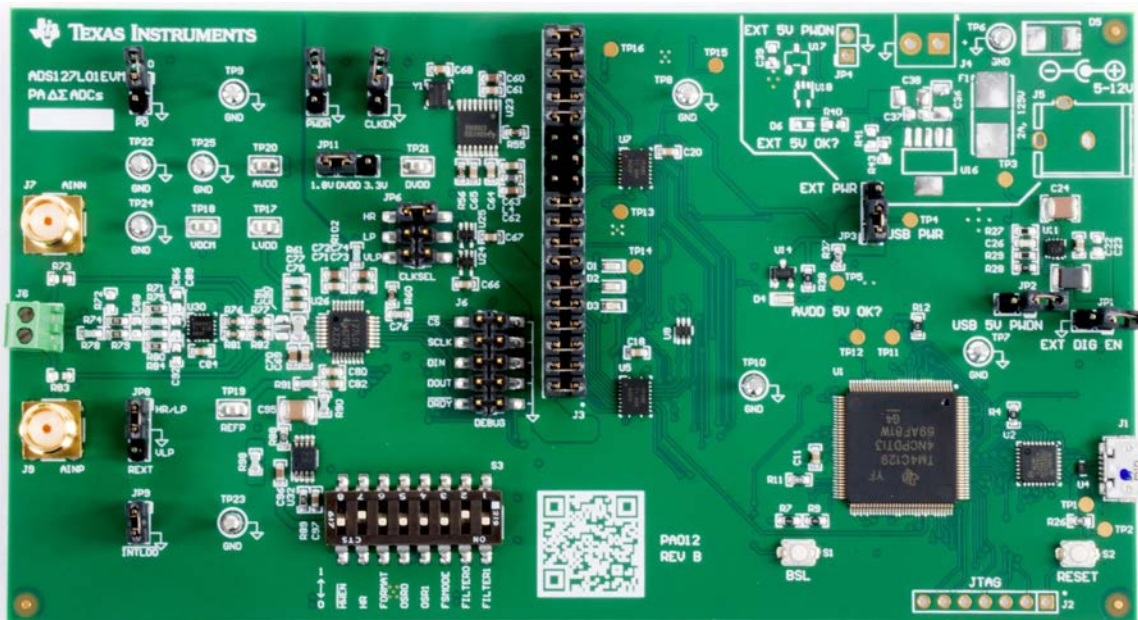


Figure 1. ADS127L01EVM

The ADS127L01EVM is an evaluation module that provides hardware and software support for evaluation of the ADS127L01 delta-sigma ADC. The EVM utilizes the [TM4C1294NCPDT](#) processor to communicate with the ADC via SPI and provide communication with a PC over USB interface. The EVM also includes a software application that runs on a PC to allow for register manipulation and data collection from the ADC.

Table 1. Related Documentation

Device	Literature Number
ADS127L01	SBAS607

Contents

1	EVM Overview	3
1.1	Description	3
1.2	Requirements	3
1.3	Software Reference	3
1.4	Supported Functionality	3
2	Quick Start	5
2.1	Default Jumper and Switch Configuration	5
2.2	Power Connection	6
2.3	Startup	6
3	Hardware Reference	7
3.1	Jumper and Switch Configuration Reference	7
3.2	Headers, Connectors, and Test Points	8
4	ADS127L01EVM Software	10
4.1	Installing the Software	10
4.2	Connecting to the EVM Hardware	11
4.3	Using the Software With the ADS127L01EVM	12
5	ADS127L01EVM Hardware	15
5.1	Analog Inputs	15
5.2	Hardware Mode Pins	16
5.3	ADC Reference	17
5.4	Power-Down Mode	17
5.5	Digital Inputs	17
5.6	Clock Inputs	18
6	Power Supply Connections	19
6.1	Powering the EVM	19
6.2	ADC Power Supplies	19
7	ADS127L01EVM Bill of Materials, PCB Layout, and Schematic	20
7.1	Bill of Materials	20
7.2	PCB Layout	26
7.3	Schematic	30

List of Figures

1	ADS127L01EVM	1
2	ADS127L01EVM Default Jumper and Switch Configuration	5
3	Delta-Sigma ADC Evaluation Software Installation Instructions	10
4	ADS127L01 Device Package Installation Instructions	11
5	ADS127L01 Device Tab and Register Map	12
6	Register Controls for the ADS127L01	13
7	Hardware Controls for the ADS127L01 Mode Pins	13
8	Analog Input Connections (Schematic)	15
9	Analog Input Connections (PCB)	15
10	Modifications to Bypass Driver Stage	15
11	Hardware Mode Input Controls (Schematic)	16
12	Hardware Mode Input Controls (PCB)	16
13	Reference Input Selection	17
14	Debug Header for Logic Analyzer (Schematic)	17
15	Debug Header for Logic Analyzer (PCB)	17
16	Clock Tree (Schematic)	18
17	Clock Tree (PCB)	18
18	Top Silkscreen	26
19	Top Layer (Positive)	26

20	Ground (Negative)	27
21	Power (Negative).....	27
22	Bottom Layer (Positive).....	28
23	Bottom Silkscreen	28
24	Bottom Silkscreen (Mirrored)	29
25	TM4C Main Schematic	30
26	TM4C Miscellaneous and Power Schematic	31
27	ADS127L01EVM Digital Header Schematic	32
28	ADS127L01EVM USB Power Schematic	33
29	ADS127L01EVM External Power Schematic.....	34
30	ADS127L01EVM Clock Tree Schematic	35
31	ADS127L01EVM ADC Main Schematic.....	36
32	ADS127L01EVM ADC Input Driver Schematic.....	37
33	ADS127L01EVM ADC Reference Schematic	38
34	ADS127L01EVM ADC Power Schematic	39

1 EVM Overview

1.1 Description

This user guide describes the operation and use of the ADS127L01 evaluation module (ADS127L01EVM). The ADS127L01 is a 24-Bit, high-speed, wide-bandwidth delta-sigma analog-to-digital converter (ADC) for precision industrial applications. This platform is intended for evaluating the ADS127L01 performance and functionality. The ADS127L01EVM kit includes the ADS127L01EVM, USB mini cable, and supporting software (SW).

This document includes a detailed description of the hardware (HW) and software, bill of materials, and schematic for the ADS127L01EVM.

Throughout this document, the terms ADS127L01EVM, demonstration kit, evaluation module, and EVM are synonymous with the ADS127L01EVM. Also, the term GUI is synonymous with *Delta-Sigma ADC Evaluation Software*, core application, and EVM software, and Tiva is synonymous with the TM4C1294NCPDT.

1.2 Requirements

1.2.1 Software Requirements

PC with Microsoft® Windows® 7 or higher operating system.

1.2.2 Hardware Requirements

PC with available USB connection.

1.3 Software Reference

See the *Delta-Sigma ADC Evaluation Software User Manual* ([SBAU260](#)) for the core software documentation or navigate to *File -> About* from within the GUI.

1.4 Supported Functionality

1.4.1 Supported Hardware Functionality

- Unipolar 3-V analog supply (AVDD)
- Unipolar 1.8-V and 3.3-V digital supply (DVDD)
- External LVDD supply

- Fully-differential or single-ended input driver
- Hardware control over device mode pins:
 - High-resolution (HR), low-power (LP), and very-low-power (VLP) mode
 - All OSR [1:0] and FILTER[1:0] settings
- SPI and frame-sync interface (frame-sync mode requires external processor)
- Digital header for debug or connection to external processor
- On-board ADC clock options (CLK): 16 MHz, 8 MHz, 4 MHz
- On-board or external ADC reference voltage (REFN always shorted to GND)
- Power-down mode

1.4.2 Supported Software Functionality

- Software control over device mode pins:
 - High-resolution (HR), low-power (LP), and very-low-power (VLP) mode
 - All OSR [1:0] and FILTER[1:0] settings
- SPI mode only
- SPI serial interface commands:
 - RESET
 - START
 - STOP
 - RDATA
 - RREG
 - WREG
- Does not support:
 - Frame-sync master mode or frame-sync slave mode
 - STATUS word readback

2 Quick Start

This section provides a guide to quickly begin using the EVM.

2.1 Default Jumper and Switch Configuration

The EVM should come configured with the settings listed in [Table 2](#) and illustrated in [Figure 2](#).

Table 2. Default Settings

Jumper	Default Position	Comment
JP1	Uninstalled	Use on-board processor
JP2	Uninstalled	USB-derived supplies enabled
JP3	1-2	AVDD and DVDD derived from regulated USB supply
JP4	N/A	Not populated
JP5	Uninstalled	Enable on-board crystal oscillator (Y1)
JP6	1-2	CLK = 16 MHz
JP7	Uninstalled	ADS127L01 powered-on
JP8	1-2	R _{EXT} = 60.4 kΩ
JP9	Installed	Internal LDO used for LVDD supply
JP10	Uninstalled	Input amplifier enabled (U30)
JP11	1-2	DVDD = 1.8 V
Switch	Default Position	Comment
S1	Open	GPIO input pulled high
S2	Open	Tiva RST pulled high
S3	HR = 1 FORMAT = 0 OSR [1:0] = 00 FSMODE = 0 ⁽¹⁾ FILTER [1:0] = 01	High-resolution mode SPI mode OSR = 32 Frame-sync slave mode ⁽¹⁾ Wideband 2 filter (transition: 0.4 F _{DATA} to 0.5 F _{DATA})

⁽¹⁾ Ignored when FORMAT = 0

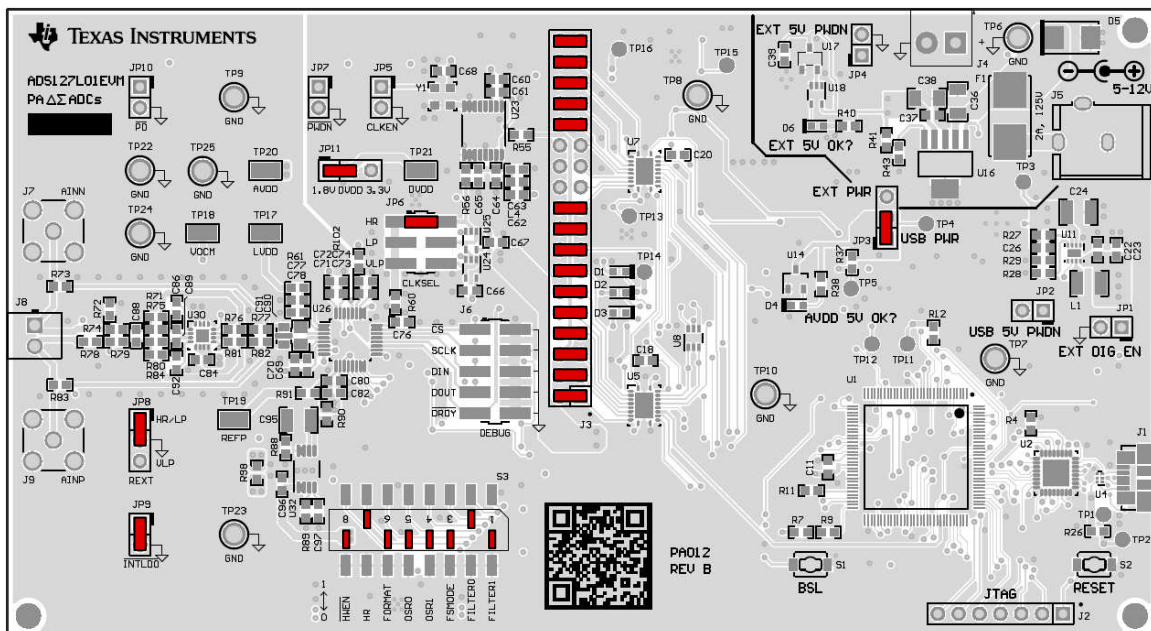


Figure 2. ADS127L01EVM Default Jumper and Switch Configuration

2.2 Power Connection

The EVM is powered via the USB interface with the PC. Connect the EVM to an available USB port to power the board.

2.3 Startup

Use the following steps at startup:

1. Install the core application onto your PC.
2. Install the ADS127L01 device package onto your PC.
3. Ensure all jumpers and switches are configured in the default configuration per [Table 2](#) and [Figure 2](#).
4. Connect the EVM to your PC using a USB cable.
5. If prompted, install any required drivers.
6. Start the software on your PC.

NOTE: The EVM has powered on correctly if D4 turns on.

3 Hardware Reference

3.1 Jumper and Switch Configuration Reference

Table 3 provides all jumper and switch configuration settings for the EVM.

Table 3. Hardware Item Descriptions

Jumper	Position	Description
JP1	Select on-board vs. external controller (U1 RST)	
	Installed	Hold on-board Tiva in reset and disable level shifters to allow external digital interface
	Uninstalled	Normal operation with on-board Tiva
JP2	Enable USB-derived power supplies (U11 EN)	
	Installed	USB-derived power supplies disabled
	Uninstalled	USB-derived power supplies enabled
JP3	Select 5-V supply to derive AVDD_5V and DVDD_3.3V	
	1-2	AVDD_5V and DVDD_3.3V derived from regulated USB supply (U12)
	2-3	Not used
JP4	Power-down external supplies (U16 EN)	
	Installed	External supplies disabled
	Uninstalled	External supplies enabled
JP5	Disable on-board crystal oscillator Y1 (CLKEN)	
	Installed	Y1 output is disabled
	Uninstalled	Y1 output is enabled
JP6	Select ADS127L01 CLK frequency (CLKSEL)	
	1-2	16 MHz
	3-4	8 MHz
	5-6	4 MHz
JP7	Place ADS127L01 in <i>Power-Down Mode</i> (RESET/PWDN)	
	Installed	ADS127L01 held in <i>Power-Down Mode</i>
	Uninstalled	Normal operation
JP8	Select R _{EXT} pull-down resistor (U26 REXT)	
	1-2	60.4 kΩ (HR and LP Mode)
	2-3	120 kΩ (VLP Mode)
JP9	Select source for ADS127L01 LVDD supply (U26 INTLDO)	
	Installed	Internal LDO enabled (LVDD sourced from AVDD)
	Uninstalled	Internal LDO disabled (LVDD sourced from external supply connected to TP17)
JP10	Power-down input driver amplifier (U26 PD)	
	Installed	Amplifier held in power-down
	Uninstalled	Normal operation
JP11	Select DVDD supply for ADS127L01 (U26 DVDD)	
	1-2	DVDD = 1.8 V
	2-3	DVDD = 3.3 V
Switch	Position	Description
S1	BSL Mode for Device Firmware Update (DFU)	
	Closed (on RESET)	Total Tiva FLASH erasure (Tiva enumerates as a DFU device on release)
	Open (on RESET)	Normal operation
S2	Reset on-board Tiva controller (U1 RST)	
	Closed	Tiva held in RESET
	Open	Normal operation

Table 3. Hardware Item Descriptions (continued)

Switch	Position	Description
S3	Hardware Mode inputs	
	Open	Logic '1'
	Closed	Logic '0'

3.2 Headers, Connectors, and Test Points

This section provides details for all of the headers, connectors, and test points on the EVM.

3.2.1 JTAG Header (not installed)

The J2 header is provided for programming the on-board processor with firmware updates or user firmware. Exercise care when using the JTAG since it is possible to erase the EVM firmware and lose communication with the EVM software. [Table 4](#) describes the J2 header functions.

Table 4. JTAG Header, J2

Function	Signal Name	Pin
Processor <i>RESET</i> Signal	RESET	1
JTAG test data out signal	TDO	2
JTAG test data in signal	TDI	3
JTAG test mode select signal	TMS	4
JTAG test clock signal	TCK	5
Debug UART receive signal	RX	6
Debug UART transmit signal	TX	7

3.2.2 Analog Inputs

Analog input signals can be connected through the SMA connectors (J7 and J9) or through the terminal block (J8). [Table 5](#) lists the analog input connections.

Table 5. Analog Inputs, J7–J9

Function	SMA Connector	Terminal Block
Analog input to AINN	J7	J8[1]
Analog input to AINP	J9	J8[2]

3.2.3 Test Points

The test points listed in [Table 6](#) may be used to probe on-board voltage supplies or to connect external voltage supplies. See the [ADS127L01EVM Hardware](#) section for any required hardware modifications when connecting an external supply.

Table 6. Test Points, TP17 – TP24

Function	Signal Name	Test Point	Input Restrictions
ADC Modulator Supply	LVDD	TP17	$1.7\text{ V} \leq \text{LVDD} \leq 1.9\text{ V}$
Input Common-Mode Voltage	VOCM	TP18	$0.55\text{ V} \leq V_{\text{OCM}} \leq 1.8\text{ V}$
ADC Reference Voltage	REFP	TP19	$0.5\text{ V} \leq V_{\text{REF}} \leq 3.0\text{ V}$
ADC Analog Supply	AVDD	TP20	$2.7\text{ V} \leq \text{AVDD} \leq 3.6\text{ V}$
ADC Digital Supply	DVDD	TP21	$1.7\text{ V} \leq \text{DVDD} \leq 3.6\text{ V}$
System Ground	GND	TP6-10, TP22-24	Connect to external source ground

3.2.4 Digital Interface Header

Table 7 lists the functions and pin numbers for all signals used on the digital interface header.

Table 7. Digital Interface Header, J3

Function	Processor Side		ADC Side	
	Signal Name	Pin Number ⁽¹⁾	Pin Number ⁽²⁾	Signal Name
GPIO Inputs for ADC <i>Hardware Mode Pins</i>	I2C0_SDA	1	2	FILTER1
	I2C0_SCL	3	4	FILTER0
	TIVA_16MHz_LT	5	6	TIVA_16MHz
	GPIO_4	7	8	FSMODE
	GPIO_3	9	10	OSR1
	GPIO_2	11	12	OSR0
	GPIO_1	13	14	FORMAT
	GPIO_0	15	16	HR
IOVDD Supply for Level Translator (U5)	DIG_VOLT2	17	18	DVDD
GPIO	I2C1_SDA	19	20	DRDY
SPI Port	SPI1_MISO/DATA1	27	28	MISO
	SPI1_MOSI/DATA0	29	30	MOSI
	SPI1_FS	31	32	\overline{CS}
	SPI1_SCLK	33	34	SCLK
IOVDD Supply for Level Translator (U7)	DIG_VOLT3	35	36	DVDD

⁽¹⁾ Odd numbered pins not included are connected to Tiva inputs whose functionality is not used for this EVM. See Figure 27 for connection details.

⁽²⁾ Even numbered pins not included are not connected to the ADS127L01.

3.2.5 Debug Header

The debug header (J6) information is presented in Table 8.

Table 8. Debug Header, J6

Function	Signal Name	Pin Number ⁽¹⁾
Digital Signals for Logic Analyzer or External Processor	\overline{CS}	1
	SCLK	3
	DIN	5
	DOUT	7
	DRDY	9

⁽¹⁾ Pins 2 – 10 (even) are tied to GND.

4 ADS127L01EVM Software

4.1 Installing the Software

4.1.1 Delta-Sigma ADC Evaluation Software

Download the *Delta-Sigma Evaluation Software* installer from the [ADS127L01EVM tool page](#) and save to a known folder. Run the installer and follow the on-screen prompts. Note that future software versions may show slightly different screens.

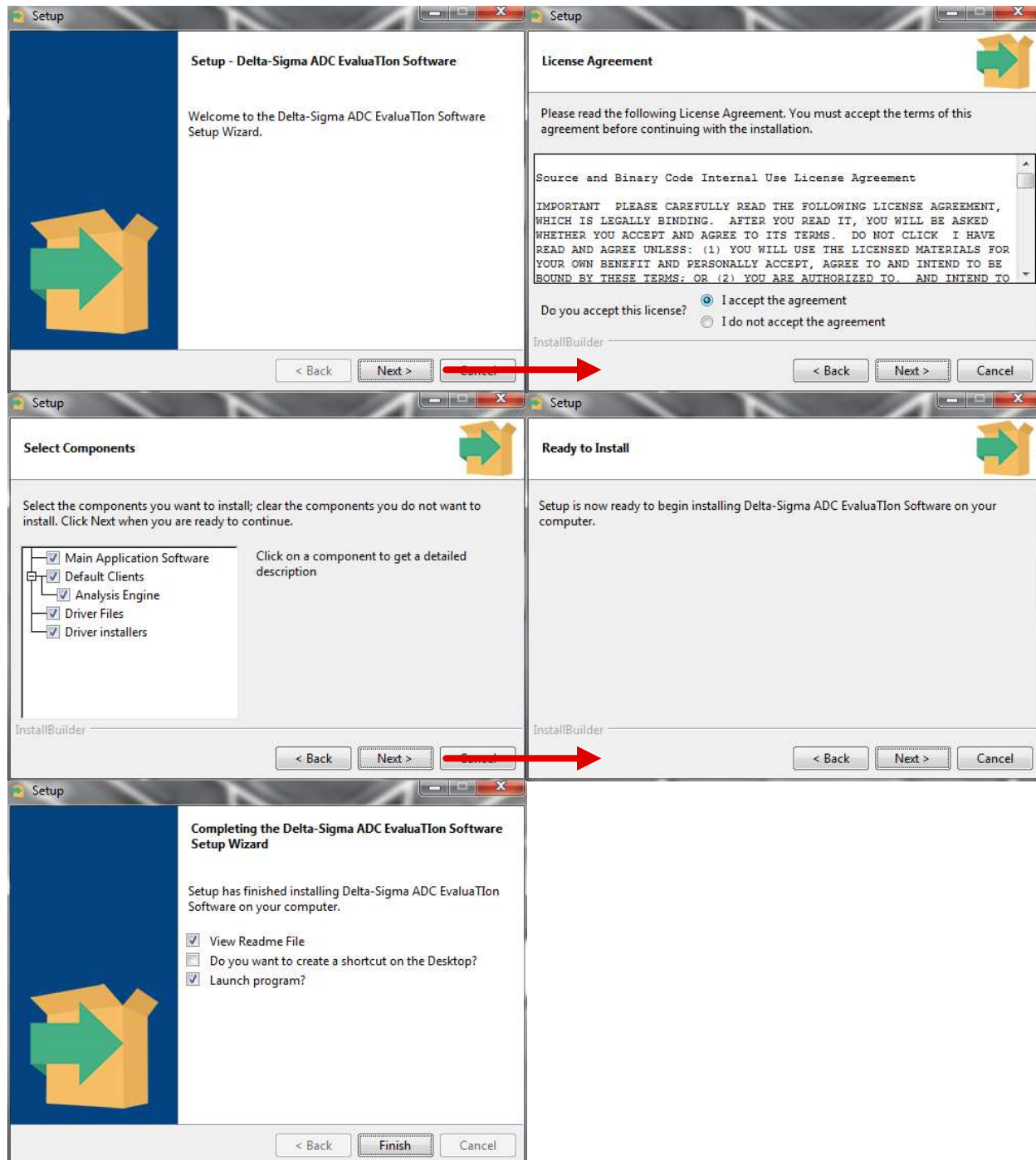


Figure 3. Delta-Sigma ADC Evaluation Software Installation Instructions

4.1.2 ADS127L01 Device Package

Download the *ADS127L01 Device Package* installer from the [ADS127L01EVM tool page](#) and save to a known folder. Run the installer and follow the on-screen prompts. Note that future software versions may show slightly different screens.

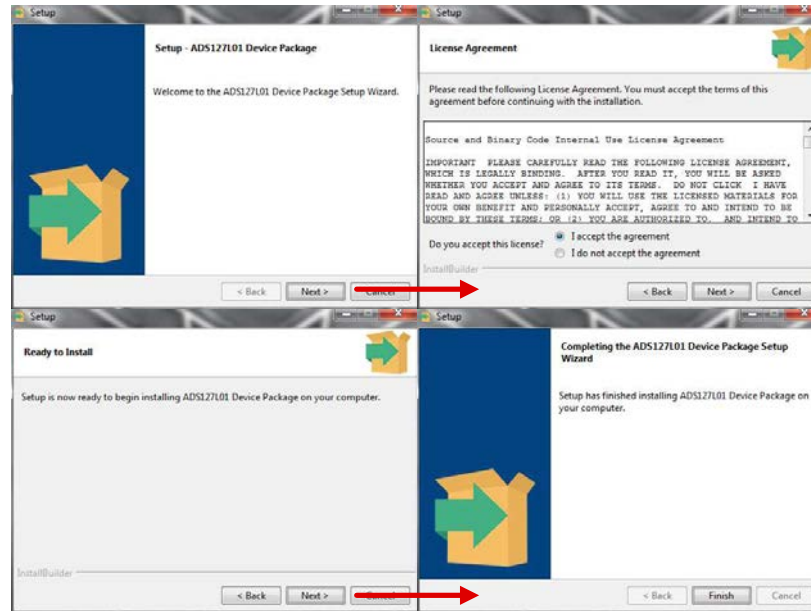


Figure 4. ADS127L01 Device Package Installation Instructions

4.2 Connecting to the EVM Hardware

After the *Delta-Sigma ADC Evaluation Software* and the *ADS127L01 Device Package* are installed, ensure that all jumpers and switches are in their default positions per [Table 2](#), and then connect the hardware with the provided USB mini cable. Start the *Delta-Sigma ADC Evaluation Software*. The GUI automatically detects the connected hardware and displays the device register map under the *Main* tab as shown in [Figure 5](#).

4.3 Using the Software With the ADS127L01EVM

This section covers the functionality of the ADS127L01 device package only. For more information about the core application, see the *Delta-Sigma ADC Evaluation Software User Manual (SBAU260)* for the core software documentation or navigate to *File -> Options* from within the GUI.

Upon startup, the GUI scans for the connected hardware. Once the ADS127L01EVM is plugged in, the welcome screen will refresh to show the *ADS127L01 Register Map* under the main *Device* tab as shown in [Figure 5](#). The *Device* tab also grants user control over register settings with read/write access (R/W) as well as the ADS127L01 hardware mode pins. Click the *Refresh/Sync* button to read back the current value in all registers and update the register map. Selecting a single register will provide a detailed description for the current values in the *Register Decode Information* panel below the register map (see lower half of [Figure 5](#)).

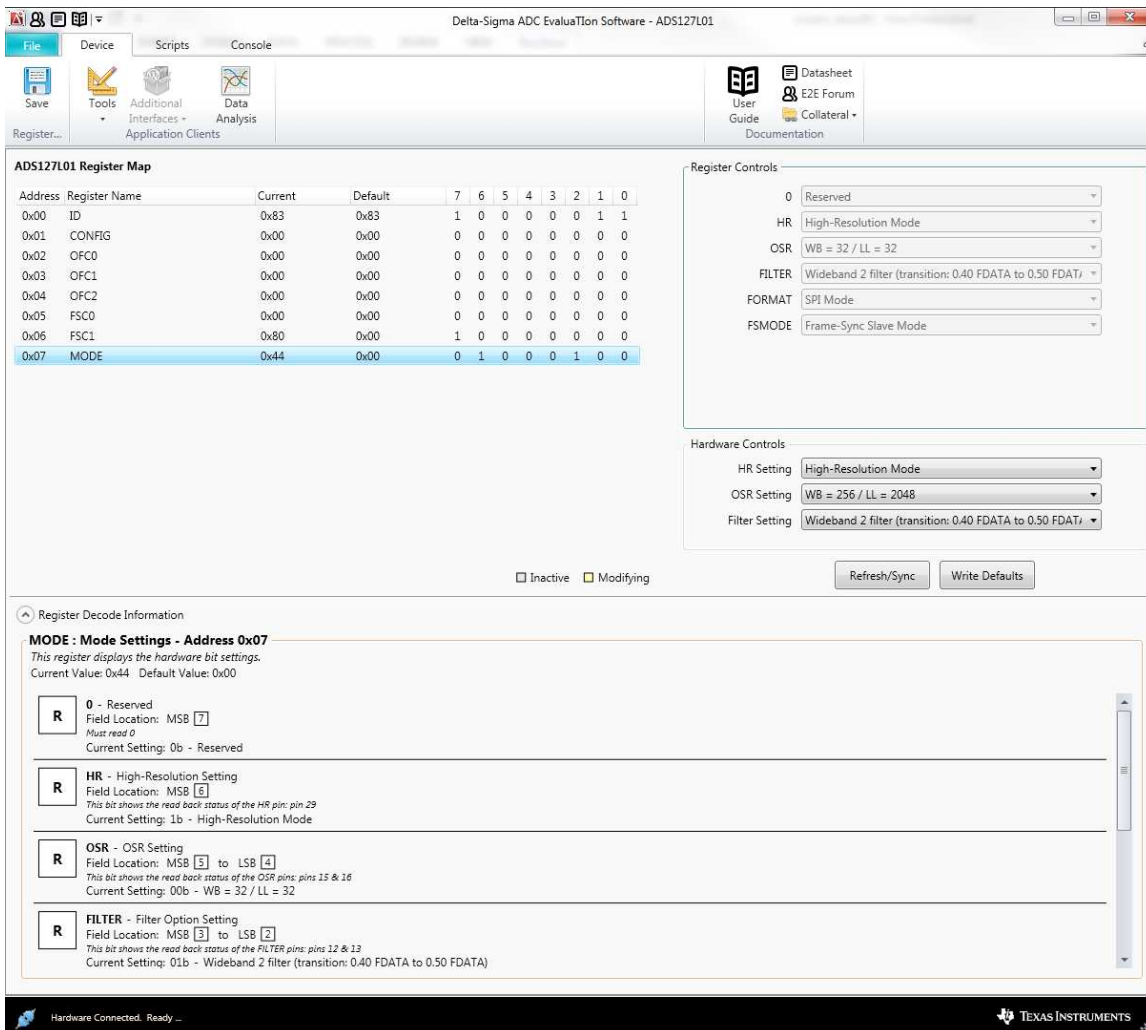


Figure 5. ADS127L01 Device Tab and Register Map

4.3.1 Register Controls

In the *Register Control* section are drop-down menu options that can be used to configure the ADS127L01 registers with R/W access. These menus correspond to each configurable bit or group of bits in that register and are highlighted upon selection. In this way, the bit segments of the register can be identified for the menu items affecting the changes. It should be noted that some of the register contents cannot be changed, such as the ID register. Figure 6 shows an example of the CONFIG register control menus.



Figure 6. Register Controls for the ADS127L01

4.3.2 Hardware Controls

The EVM software provides an alternate way to configure the ADS127L01 hardware mode pins when S3[1] is open (that is, in the '1' position). These controls can be found underneath the *Register Controls* on the *Device* tab. Only the SPI interface is supported with the EVM software, so FORMAT and FSMODE have been omitted from the Hardware Mode Controls and are held low by Tiva GPIO pins. HR, OSR[1:0], and FILTER[1:0] can be configured using the drop-down menus as shown in Figure 7.

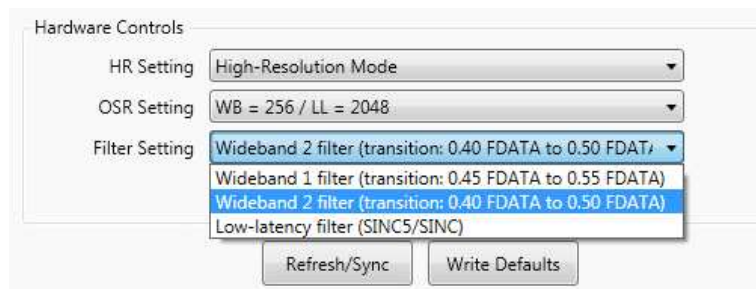


Figure 7. Hardware Controls for the ADS127L01 Mode Pins

4.3.3 Data Collection

Data is collected by clicking the *Data Analysis* button from the ribbon menu or by entering the COLLECT <n> command in the entry field under the *Console* tab. The *Analysis Engine* launches in a separate window and can be used to collect, analyze, and save data from the EVM. For more information about the *Analysis Engine*, see the *Delta-Sigma ADC Evaluation Software User Manual* (SBAU260).

4.3.4 SPI Commands

The ADS127L01EVM commands listed in [Table 9](#) are one of three types:

- *Basic GUI Commands*: commands used by the *Delta-Sigma ADC Evaluation Software*
- *Device Firmware Commands*: SPI opcodes recognized by the ADS127L01
- *EVM Firmware Commands*: commands created specifically for use with the ADS127L01EVM

All commands are available for use within the *Scripts* and the *Console* tabs. For more information about using scripts, see the *Delta-Sigma ADC Evaluation Software User Manual (SBAU260)*.

Table 9. ADS127L01EVM Software Commands

Command Name	Command Syntax	Argument Details	Description
Basic GUI Commands			
ID	ID		Send EVM identification
REGMAP	REGMAP		Return the current contents of the ADC register map
COLLECT	COLLECT <n>	n: 0 to 64,000	Collect n samples
COLLECTSTOP	COLLECTSTOP		Stop data collection in progress
COMMANDLIST	COMMANDLIST		Return the complete list of available commands
Device Firmware Commands			
RESET	RESET		Reset the device to power-on values
START ⁽¹⁾	START		Start/restart (synchronize) conversions
STOP ⁽¹⁾	STOP		Stop conversions
RDATA ⁽²⁾	RDATA		Read data by command
RREG	RREG <rr> <nn>	rr: 00h to 07h nn: 00h to 07h	Read (nn + 1) registers starting at address rr
WREG	WREG <rr> <nn> <value 0> ... <value nn>	rr: 00h to 07h nn: 00h to 07h value: 00h to FFh	Write (nn + 1) registers starting at address rr
EVM Firmware Commands			
HR	HR <x>	value: 0b, 1b	Configure the High-Resolution Setting where x corresponds to the HR pin
OSR	OSR <xx>	value: 00b, 01b, 10b, 11b	Configure the OSR Setting where xx corresponds to the OSR[1:0] pins
FILTER	FILTER <xx>	value: 00b, 01b, 10b	Configure the Filter Setting where xx corresponds to the FILTER[1:0] pins

⁽¹⁾ START and STOP commands are only used when the START pin is tied low. See [Figure 31](#) before modifying the EVM hardware.

⁽²⁾ SCLK is configured for 200 kHz when this command is invoked through the EVM software. Configure the data rate (f_{DATA}) to be less than 14.4 kSPS when $\overline{CS_ENB} = 0$ or less than 11.2kSPS when $\overline{CS_ENB} = 1$.

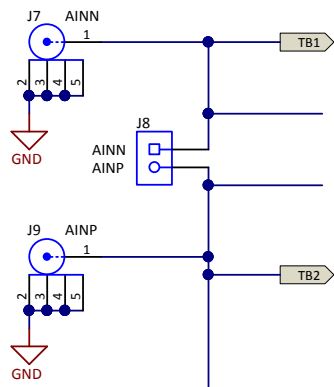
5 ADS127L01EVM Hardware

5.1 Analog Inputs

Analog input signals can be connected through the SMA connectors (J7 and J9) or through the terminal block (J8).

By default, the EVM is configured for a fully-differential analog input signal. To configure the input driver amplifier (U30) for a signal-ended input, J7 and J8[1] can be tied to GND by installing R72. Use either J9 or J8[2] to connect a single-ended analog input.

The default input driver circuit uses the THS4541, fully-differential amplifier in a unity-gain configuration with a single-pole R-C filter at the output. Multiple passive components around the amplifier are intentionally left uninstalled to give users the flexibility to customize the input drive circuit for their specific application. In addition, the table shown in Figure 32 lists alternative driver amplifiers with various bandwidth, noise, and power specifications that can also be used to drive the ADS127L01 depending on the performance criteria of an application.



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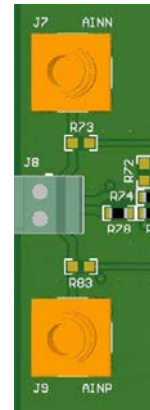
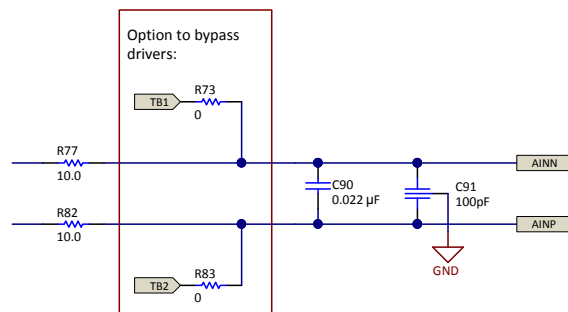


Figure 9. Analog Input Connections (PCB)

Figure 8. Analog Input Connections (Schematic)

The on-board input driver may be bypassed to evaluate other driver solutions or to test the ADC performance directly. To bypass U30, uninstall R74, R77, R79, and R82. Install R73 and R83 with 0-Ω resistors. J7 and J8[1] will connect directly to AINN, and J9 and J8[2] will connect directly to AINP on the ADS127L01. Ensure that the analog inputs are within the input voltage limits of the ADS127L01.



Modifications to Bypass Driver Stage	
Install	Uninstall
R73, R83	R74, R77, R79, R82

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Figure 10. Modifications to Bypass Driver Stage

U31 provides an option to buffer an input signal from a source with an unknown output impedance. Components are suggested on the EVM schematic but are not installed by default. In addition, U31 requires bipolar supplies, which can be generated on-board with additional components (see Section 6.1.2).

5.2 Hardware Mode Pins

The ADS127L01 uses hardware mode pins to select the operating mode, interface mode, digital filter response, and oversampling ratio (OSR). These mode selections are reflected in register 07h. The register bit settings are controlled by externally pulling the respective pins to a logic high or low level.

S3[1] must be closed (that is, in the '0' position) to configure the hardware mode pins with the EVM hardware. Each hardware mode pin is tied to DVDD through a switch on S3 and a 100-k Ω , pull-up resistor (R69). Placing the switches on S3 in the '1' position will pull up the respective mode pins to DVDD. Placing the switches in the '0' position will pull down the respective mode pins to GND. FORMAT must always be low to use the EVM with the provided software.

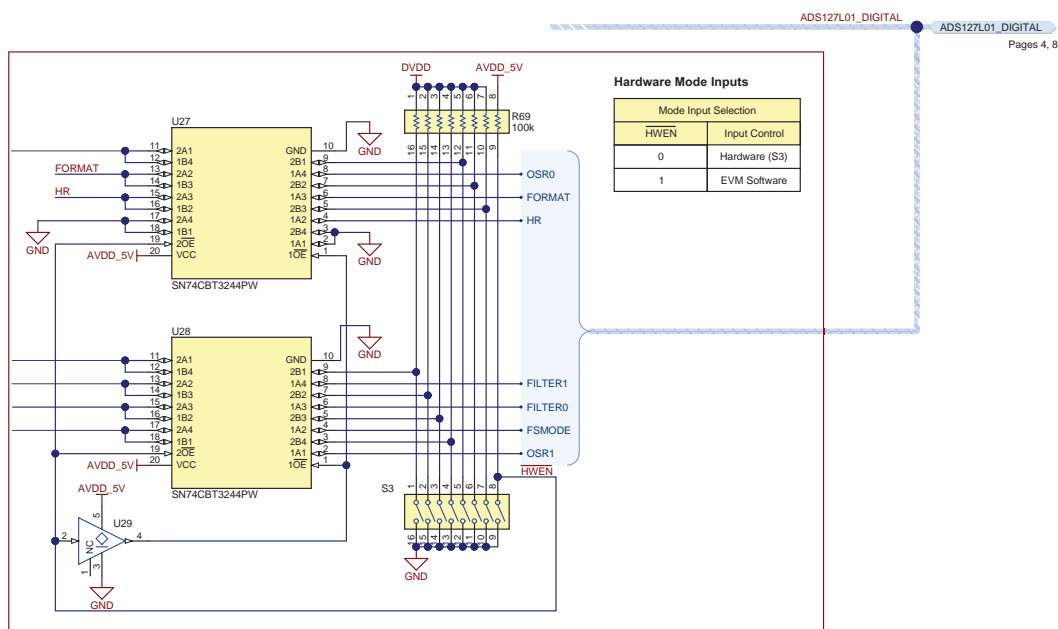


Figure 11. Hardware Mode Input Controls (Schematic)

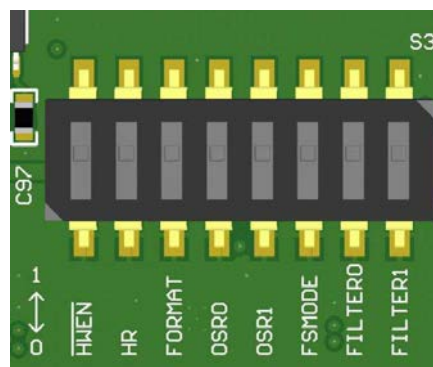


Figure 12. Hardware Mode Input Controls (PCB)

Placing S3[1] in the '1' position allows the EVM software to set the hardware mode pins. Only the HR, OSR[1:0], and FILTER[1:0] pins can be controlled using the provided EVM software. FORMAT and FSMODE will be held low by Tiva GPIOs.

5.3 ADC Reference

The reference voltage on the ADS127L01 is the voltage difference between REFP and REFN. REFN is tied directly to GND on the EVM.

The default reference driver on the EVM is the REF6025. This driver provides a precision 2.5-V reference voltage and includes an integrated buffer to drive the ADS127L01 reference inputs directly. The output of the REF6025 is connected to REFP through R90.

A footprint for an alternate reference driver is located on the bottom of the EVM. Suggested components are shown in the EVM schematic, including the REF5025 and the OPA320 (see Figure 33). Before populating this alternate reference driver circuit, be sure to uninstall R90 and install R92 with a 0-Ω resistor.

The reference voltage (REFP) may be probed at TP19. TP19 may also be used to connect an external reference voltage source to the ADS127L01; however, both R90 and R92 must be uninstalled. Performance may not be optimal when connecting a reference voltage in this manner. Ensure that the external reference voltage is within the limits provided in Table 6.

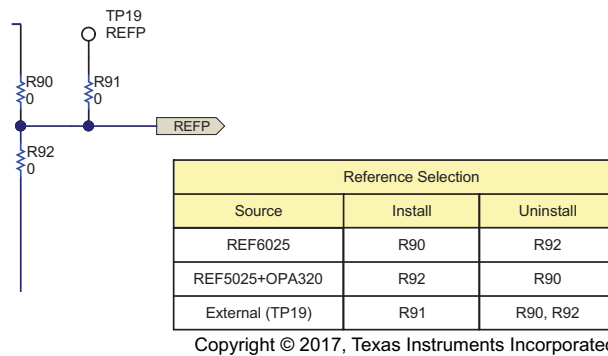


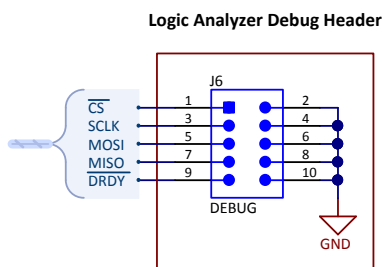
Figure 13. Reference Input Selection

5.4 Power-Down Mode

The ADS127L01 can be placed in *Power-Down Mode* by installing JP7. When evaluating the device in *Power-Down Mode*, R59, R64, and R65 must be populated with 1-MΩ resistors.

5.5 Digital Inputs

Access the digital signals of the device via the debug header (J6). This header allows for the connection to a logic analyzer or to another processor when the Tiva microcontroller is not used. Each digital signal is paired with a header pin connected to GND (pins 2-10, even), see Table 8.



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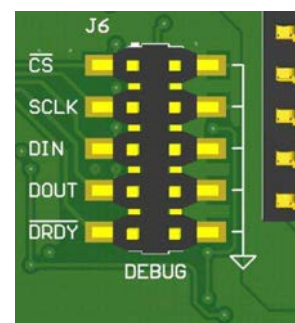


Figure 15. Debug Header for Logic Analyzer (PCB)

Figure 14. Debug Header for Logic Analyzer (Schematic)

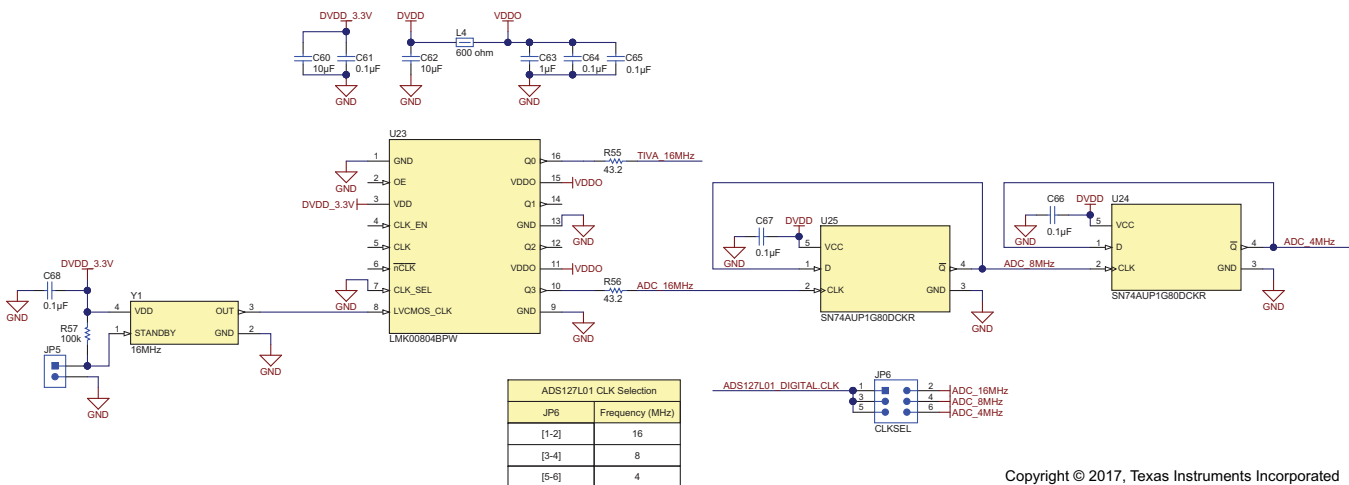
The START pin on the ADS127L01 is tied to DVDD through a 100-kΩ pullup resistor (R67) by default. The low side of R67 can be soldered to a GND connection with a jumper wire to allow for external control of the ADS127L01 conversions via the START and STOP SPI commands.

5.6 Clock Inputs

The on-board oscillator (Y1) provides a 16-MHz, low-jitter clock for the ADS127L01EVM. This clock source is buffered and fanned out to both the ADS127L01 and the Tiva microprocessor. The EVM firmware can only run with a 16-MHz input clock frequency for the Tiva microcontroller.

Two D flip-flops (U24 and U25) are cascaded to divide the buffered Y1 output into 8- and 4-MHz frequencies that can be connected to the ADS127L01 CLK pin as shown in Figure 16. All on-board clock frequencies are available on JP6 (see Table 3).

It is possible to connect an external clock source to JP6[1, 3, 5] for finer control over the ADS127L01 input CLK frequency; however, note that any clock source which is not synchronous to Y1 will produce intermodulation harmonics. These harmonics may appear in the output data frequency spectrum and degrade the system noise performance. When connecting an external microcontroller, it is recommended to power-down Y1 by installing JP5 and provide a clock source which is synchronous to the microcontroller.



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Figure 16. Clock Tree (Schematic)

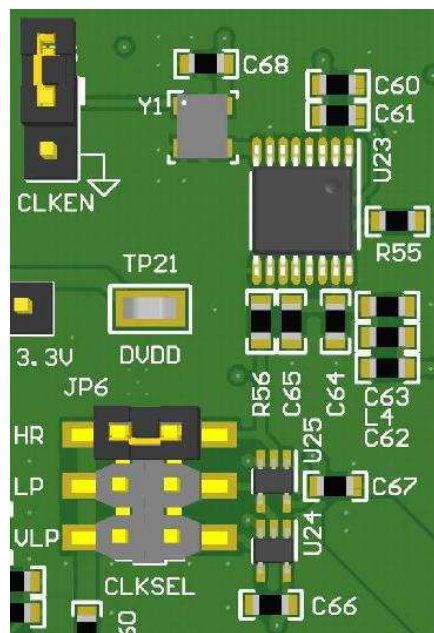


Figure 17. Clock Tree (PCB)

6 Power Supply Connections

6.1 Powering the EVM

The EVM has two different power options: USB or external power.

6.1.1 USB Power

By default, the EVM is configured to use the regulated USB power supply (USB_REG) to generate all other supplies. To power the EVM via the regulated USB supply, connect the EVM to a PC via the USB cable and set JP3 to the [1-2] position.

6.1.2 External Power

To power the EVM from an external supply, connect 5 V to JP3[2]. Be sure to share the external supply ground with the EVM ground using one of the GND test points.

To generate the additional ± 12 -V, bipolar supplies for U31, install all components on the [External Power schematic page](#). Connect an external 5- to 12-V DC wall supply to J4 or J5 and uninstall JP4.

6.2 ADC Power Supplies

The ADS127L01 supplies are provided by connections to AVDD, LVDD, and DVDD. The ADC is designed to be operated by unipolar analog and digital supplies only. This system uses a single ground plane such that AVSS = DGND.

6.2.1 Analog Supplies

One TPS7A4901 (U35) is used to generate a 3-V analog supply from the AVDD_5V rail. This 3-V supply is used to power the analog front-end circuitry (LDO_3V) and connects to AVDD through R98 (1 Ω). Measure the voltage across R98 or insert an ammeter in series to measure the AVDD supply current. To use an external AVDD supply, uninstall R98 and connect the supply source to TP20. Ensure that the external AVDD supply is within the limits provided in [Table 6](#). Also, be sure to share the external supply ground with the EVM ground using one of the GND test points.

When JP9 is installed, the LVDD supply is derived from AVDD using an internal LDO in the ADS127L01. To drive an external LVDD supply, uninstall JP9 and connect the external supply voltage to TP17. Ensure that the external LVDD supply is within the limits provided in [Table 6](#). Also, be sure to share the external supply ground with the EVM ground using one of the GND test points.

6.2.2 Digital Supplies

A second TPS7A4901 (U36) is used to generate a 1.8-V digital supply (DVDD_1.8V) from the DVDD_3.3V rail. The ADC digital supply is selected by setting JP11 to either [1-2] = 1.8 V or [2-3] = 3.3 V. Measure the voltage across R102 (1 Ω) or insert an ammeter in series to measure the DVDD supply current. To use an external DVDD supply, uninstall JP11 and connect the supply source to TP21. Ensure that the external DVDD supply is within the limits provided in [Table 6](#). Also, be sure to share the external supply ground with the EVM ground using one of the GND test points.

7 ADS127L01EVM Bill of Materials, PCB Layout, and Schematic

7.1 Bill of Materials

Table 10 lists the EVM bill of materials.

Table 10. ADS127L01 Bill of Materials⁽¹⁾

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		PA012	Any		
C1, C14	2	2.2uF	CAP, CERM, 2.2 μ F, 16 V, +/- 10%, X7R, 0603	0603	GRM188Z71C225KE43	Murata		
C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C16, C17, C18, C19, C20, C21, C22, C27, C61, C64, C65, C66, C67, C68, C69, C71, C73, C80, C84	30	0.1uF	CAP, CERM, 0.1 μ F, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX		
C7, C25, C28, C60, C62, C70, C72, C74, C85, C96, C106, C107, C110, C111	14	10uF	CAP, CERM, 10 μ F, 25 V, +/- 20%, X5R, 0603	0603	GRM188R61E106MA73D	Murata		
C15, C30, C31, C33, C34, C63, C75, C77, C78, C81, C82, C97	12	1uF	CAP, CERM, 1 μ F, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden		
C24	1	22uF	CAP, CERM, 22 μ F, 16 V, +/- 20%, X7R, 1210	1210	C3225X7R1C226M	TDK		
C26	1	100pF	CAP, CERM, 100 pF, 25 V, +/- 10%, X7R, 0603	0603	06033C101KAT2A	AVX		
C29, C32, C35	3	1000pF	CAP, CERM, 1000 pF, 100 V, +/- 5%, X7R, 0603	0603	06031C102JAT2A	AVX		
C76	1	10pF	CAP, CERM, 10 pF, 100 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C2A100JA01D	Murata		
C83, C87	2	0.22uF	CAP, CERM, 0.22 μ F, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E224KA88D	Murata		
C90	1	0.022uF	CAP, CERM, 0.022 μ F, 50 V, +/- 5%, C0G/NP0, 0805	0805	GRM21B5C1H223JA01L	Murata		
C95	1	22uF	CAP, CERM, 22 μ F, 25 V, +/- 10%, X7R, 1210	1210	GRM32ER71E226KE15L	Murata		
C105, C108, C109, C112	4	0.01uF	CAP, CERM, 0.01 μ F, 25 V, +/- 5%, C0G/NP0, 0603	0603	C1608C0G1E103J	TDK		
D1, D2, D4	3	Green	LED, Green, SMD	LED_0603	LTST-C191TGKT	Lite-On		
D3	1	Red	LED, Red, SMD	LED_0603	LTST-C191KRKT	Lite-On		
H1, H2, H3, H4	4		Bumpon, Cylindrical, 0.312 X 0.200, Black	Black Bumpon	SJ61A1	3M		
J1	1		Connector, Receptacle, Micro-USB Type B, R/A, Bottom Mount SMT	7.5x2.45x5mm	0473460001	Molex		
J3	1		Header, 100mil, 18x2, Gold, TH	18x2 Header	TSW-118-07-G-D	Samtec		
J6	1		Header, 2.54mm, 5x2, Gold, SMT	Header, 2.54mm, 5x2, SMT	TSM-105-01-L-DV	Samtec		
J7, J9	2		SMA Straight Jack, Gold, 50 Ohm, TH	SMA Straight Jack, TH	901-144-8RFX	Amphenol RF		
J8	1		Terminal Block, 2.54mm, 2x1, Brass, TH	Terminal Block, 2.54mm, 2-pole, Brass, TH	OSTVN02A150	On-Shore Technology		
JP1, JP2, JP5, JP7, JP9, JP10	6		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
JP3, JP8, JP11	3		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		
JP6	1		Header, 2.54mm, 3x2, Gold, SMT	Header, 2.54mm, 3x2, SMT	TSM-103-01-L-DV	Samtec		

⁽¹⁾ Unless otherwise noted in the Alternate Part Number or Alternate Manufacturer columns, all parts may be substituted with equivalents.

Table 10. ADS127L01 Bill of Materials⁽¹⁾ (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
L1	1	1uH	Inductor, Wirewound, Ferrite, 1 µH, 2.05 A, 0.045 ohm, SMD	1210	LQH32PN1R0NN0	Murata		
L4	1	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 0.3 A, 0603	0603	HZ0603C601R-10	Laird-Signal Integrity Products		
R1, R4, R5, R8, R18, R24	6	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale		
R2, R38	2	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	CRCW06031K00FKEA	Vishay-Dale		
R3	1	8.06k	RES, 8.06 k, 1%, 0.1 W, 0603	0603	CRCW06038K06FKEA	Vishay-Dale		
R6, R10	2	100	RES, 100, 1%, 0.1 W, 0603	0603	CRCW0603100RFKEA	Vishay-Dale		
R7, R12, R31, R34	4	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale		
R9	1	1.00Meg	RES, 1.00 M, 1%, 0.1 W, 0603	0603	CRCW06031M00FKEA	Vishay-Dale		
R11	1	4.87k	RES, 4.87 k, 1%, 0.1 W, 0603	0603	CRCW06034K87FKEA	Vishay-Dale		
R13	1	51	RES, 51, 5%, 0.1 W, 0603	0603	CRCW060351R0JNEA	Vishay-Dale		
R14, R15, R16, R17, R19, R75, R78, R80, R90, R91	10	0	RES, 0, 5%, 0.125 W, 0603	0603	MCT06030Z0000ZP500	Vishay/Beyschlag		
R20, R25, R30, R57, R58, R62, R67, R68	8	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale		
R21, R22, R23	3	681	RES, 681, 1%, 0.1 W, 0603	0603	CRCW0603681RFKEA	Vishay-Dale		
R26, R37, R39	3	0.1	RES, 0.1, 1%, 0.1 W, 0603	0603	ERJ-L03KF10CV	Panasonic		
R27	1	768k	RES, 768 k, 1%, 0.1 W, 0603	0603	RC0603FR-07768KL	Yageo America		
R28	1	20.0k	RES, 20.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0720KL	Yageo America		
R29	1	215k	RES, 215 k, 1%, 0.1 W, 0603	0603	RC0603FR-07215KL	Yageo America		
R55, R56	2	43.2	RES, 43.2, 0.1%, 0.1 W, 0603	0603	RT0603BRD0743R2L	Yageo America		
R60, R77, R82	3	10.0	RES, 10.0, 0.1%, 0.1 W, 0603	0603	CRT0603-BY-10R0ELF	Bourns		
R61, R98, R102	3	1.00	RES, 1.00, 0.5%, 0.1 W, 0603	0603	RT0603DRE071RL	Yageo America		
R63	1	60.4k	RES, 60.4 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE0760K4L	Yageo America		
R66, R89	2	120k	RES, 120 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE07120KL	Yageo America		
R69	1	100k	RES, 100 k, 5%, 0.0625 W, AEC-Q200 Grade 1, Resistor Array - 8x1	Resistor Array - 8x1	EXB-2HV104JV	Panasonic		
R70	1	20.0k	RES, 20.0 k, 1%, 0.1 W, 0603	0603	CRCW060320K0FKEA	Vishay-Dale		
R71, R74, R79, R84	4	1.00k	RES, 1.00 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD071KL	Yageo America		
R76, R81	2	15.0	RES, 15.0, 0.1%, 0.1 W, 0603	0603	RT0603BRD0715RL	Yageo America		
R88	1	0.047	RES, 0.047, 1%, 0.1 W, 0603	0603	ERJ-L03KF47MV	Panasonic		
R99	1	7.68k	RES, 7.68 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE077K68L	Yageo America		
R100	1	4.99k	RES, 4.99 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE074K99L	Yageo America		
R101	1	5.23k	RES, 5.23 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE075K23L	Yageo America		
R103	1	10.0k	RES, 10.0 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE0710KL	Yageo America		
S1, S2	2		Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch		
S3	1		Switch, Slide, SPST 8 poles, SMT	Switch, 8Pos, 21.8x3.8x6.7 mm	219-8MST	CTS Electrocomponents		

Table 10. ADS127L01 Bill of Materials⁽¹⁾ (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
SH-J1, SH-J2, SH-J3, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10, SH-J11, SH-J12, SH-J13, SH-J14, SH-J15, SH-J16, SH-J17, SH-J18, SH-J19, SH-J20, SH-J21, SH-J22, SH-J23, SH-J24, SH-J25, SH-J26	25	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP6, TP7, TP8, TP9, TP10, TP22, TP23, TP24, TP25	9	Double	Terminal, Turret, TH, Double	Keystone1573-2	1573-2	Keystone		
TP17, TP18, TP19, TP20, TP21	5	SMT	Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone		
U1	1		Tiva C Series Microcontroller, PDT0128A	PDT0128A	TM4C1294NCPDTI3R	Texas Instruments	TM4C1294NCPDTI3	Texas Instruments
U2	1		Highly Integrated Full Featured Hi-Speed USB 2.0 ULPI Transceiver, QFN-32	5x5 QFN-32	USB3320C-EZK	Microchip		
U3	1		High-Speed USB 2.0 (480 Mbps) 1:2 Multiplexer / Demultiplexer Switch with Single Enable, 6 ohm RON, 2.5 to 3.3V, -40 to 85 degC, 10-Pin UQFN (RSE), Green (RoHS & no Sb/Br)	RSE0010A	TS3USB221ERSER	Texas Instruments	Equivalent	Texas Instruments
U4	1		USB ESD Solution with Power Clamp, 4 Channels, -40 to +85 degC, 6-pin SON (DRY), Green (RoHS & no Sb/Br)	DRY0006A	TPD4S012DRYR	Texas Instruments	Equivalent	Texas Instruments
U5, U7	2		8-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR FOR OPEN-DRAIN AND PUSH-PULL APPLICATIONS, RGY0020A	RGY0020A	TXS0108ERGYR	Texas Instruments		Texas Instruments
U6, U10	2		SINGLE BUFFER/DRIVER WITH OPEN-DRAIN OUTPUT, DCK0005A	DCK0005A	SN74LVC1G07DCKR	Texas Instruments	SN74LVC1G07DCKT	Texas Instruments
U8	1		Dual Inverter Buffer/Driver With Open-Drain Outputs, DCK0006A	DCK0006A	SN74LVC2G06DCKR	Texas Instruments		Texas Instruments
U9	1		Single Inverter Buffer/Driver With Open-Drain Output, DCK0005A	DCK0005A	SN74LVC1G06DCKR	Texas Instruments	SN74LVC1G06DCKT	Texas Instruments
U11	1		TINY 1.5-A BOOST CONVERTER WITH ADJUSTABLE INPUT CURRENT LIMIT, DSG0008A	DSG0008A	TPS61252DSGR	Texas Instruments	TPS61252DSGT	Texas Instruments
U12	1		36-V, 1-A, 4.17-uVRMS, RF LDO Voltage Regulator, RGW0020A	RGW0020A	TPS7A4700RGWR	Texas Instruments	TPS7A4700RGWT	Texas Instruments
U13	1		Single Output High PSRR LDO, 150 mA, Fixed 1.8 V Output, 2.5 to 6.5 V Input, with Low IQ, 5-pin SC70 (DCK), -40 to 85 degC, Green (RoHS & no Sb/Br)	DCK0005A	TPS71718DCKR	Texas Instruments	Equivalent	Texas Instruments
U14	1		3-Pin Voltage Supervisors with Active-Low, Open-Drain Reset, DBZ0003A	DBZ0003A	TLV803MDBZR	Texas Instruments	TLV803MDBZT	Texas Instruments
U15	1		1-A Low-Dropout Regulator With Reverse Current Protection, DRV0006A	DRV0006A	TPS73733DRVR	Texas Instruments	TPS73733DRVT	Texas Instruments
U23	1		Low Skew, 1-to-4 Multiplexed Differential/LVCMOS-to-LVCMOS/TTL Fanout Buffer, PW0016A	PW0016A	LMK00804BPW	Texas Instruments		Texas Instruments
U24, U25	2		LOW-POWER SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP, DCK0005A	DCK0005A	SN74AUP1G80DCKR	Texas Instruments	SN74AUP1G80DCKT	Texas Instruments
U26	1		24-Bit, High-Speed, Wide-Bandwidth Analog-to-Digital Converter, PBS0032A	PBS0032A	ADS127L01IPBS	Texas Instruments		Texas Instruments
U27, U28	2		Octal FET Bus Switch, PW0020A	PW0020A	SN74CBT3244PW	Texas Instruments		Texas Instruments
U29	1		Single Inverter Gate, DBV0005A	DBV0005A	SN74LVC1G04QDBVRQ1	Texas Instruments		Texas Instruments
U30	1		Low Power, Precision, 160MHz, Fully Differential Amplifier, RGT0016A (VQFN-16)	RGT0016A	THS4551IRGTR	Texas Instruments	THS4551IRGTT	Texas Instruments

Table 10. ADS127L01 Bill of Materials⁽¹⁾ (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
U32	1		High-Precision Voltage Reference with Integrated High-Bandwidth Buffer, DGK0008A	DGK0008A	REF6025IDGK	Texas Instruments		Texas Instruments
U35, U36	2		+36V, +150mA, Ultralow-Noise, Positive LINEAR REGULATOR, DGN0008D	DGN0008D	TPS7A4901DGNR	Texas Instruments	TPS7A4901DGNT	Texas Instruments
Y1	1		Oscillators, 16MHz, CMOS, 1.8 to 3.3V, SMD	4-Pin SMD, Body 3.2 x 2.5 mm , Height 0.9 mm	ASEMB-16.000MHZ-XY-T	Abracon Corporation	ASEMB-16.000MHZ-LY-T	
C23, C100, C102	0	10uF	CAP, CERM, 10 µF, 25 V, +/- 20%, X5R, 0603	0603	GRM188R61E106MA73D	Murata		
C36, C38, C40, C43, C44, C54, C55	0	10uF	CAP, CERM, 10 µF, 35 V, +/- 10%, X7R, 1206	1206	GMK316AB7106KL	Taiyo Yuden		
C37, C46, C48, C52, C57, C93, C94, C99	0	0.1uF	CAP, CERM, 0.1 µF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX		
C39, C42, C47, C53, C58	0	0.01uF	CAP, CERM, 0.01 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E103KA01D	Murata		
C41, C101	0	1uF	CAP, CERM, 1 µF, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden		
C45, C56	0	10uF	CAP, CERM, 10 µF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	Murata		
C49	0	1100pF	CAP, CERM, 1100 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H112JA01D	Murata		
C50	0	0.22uF	CAP, CERM, 0.22 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E224KA88D	Murata		
C51	0	10pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	06035A100JAT2A	AVX		
C59	0	4700pF	CAP, CERM, 4700 pF, 100 V, +/- 10%, X7R, 0603	0603	06031C472KAT2A	AVX		
C79	0	10pF	CAP, CERM, 10 pF, 100 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C2A100JA01D	Murata		
C86, C92	0	470pF	CAP, CERM, 470 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	06035A471JAT2A	AVX		
C88	0	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	GRM1885C1H102FA01J	Murata		
C89	0	100pF	CAP, CERM, 100 pF, 100 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C2A101JA01D	Murata		
C91	0	100pF	CAP, CERM, 100 pF, 100 V, +/- 20%, NP0, 0805	0805	101X15N101MV4E	Johanson Technology		
C98	0	2.2uF	CAP, CERM, 2.2 µF, 16 V, +/- 10%, X7R, 0603	0603	GRM188Z71C225KE43	Murata		
C103	0	22uF	CAP, CERM, 22 µF, 25 V, +/- 10%, X7R, 1210	1210	GRM32ER71E226KE15L	Murata		
C104	0	22uF	CAP, CERM, 22 µF, 10 V, +/- 20%, X7R, 0805	0805	GRM21BZ71A226ME15L	Murata		
D5	0	12V	Diode, TVS, Uni, 12 V, 600 W, SMB	SMB	SMBJ12A-13-F	Diodes Inc.		
D6	0	Green	LED, Green, SMD	LED_0603	LTST-C191TGKT	Lite-On		
D7	0	20V	Diode, Schottky, 20 V, 1 A, SOD-123F	SOD-123F	PMEG2010AEH,115	NXP Semiconductor		
D8	0	20V	Diode, Schottky, 20 V, 1.1 A, DO-219AB	DO-219AB	SL02-GS08	Vishay-Semiconductor		
F1	0		Fuse, 2 A, 125VAC/VDC, SMD	SMD, 2-Leads, Body 9.73x5.03mm	0154002.DRT	Littelfuse		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
H5	0		CABLE USB-A TO MICRO USB-B 0.5M This is a kitting item.	Used in PnP output and some BOM reports	102-1092-BL-00100	CNC Tech	-	-
J2	0		Header, 100mil, 7x1, Gold, TH	7x1 Header	TSW-107-07-G-S	Samtec		
J4	0		Terminal Block, 3.5mm Pitch, 2x1, TH	7.0x8.2x6.5mm	ED555/2DS	On-Shore Technology		
J5	0		Connector, DC Jack 2.1X5.5 mm, TH	POWER JACK, 14.4x11x9mm	PJ-102A	CUI Inc.		

Table 10. ADS127L01 Bill of Materials⁽¹⁾ (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
JP4	0		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
L2	0	3.3uH	Inductor, Shielded Drum Core, Ferrite, 3.3 µH, 1.5 A, 0.033 ohm, SMD	CDPH4D19F	CDPH4D19FNP-3R3MC	Sumida		
L3	0	10uH	Inductor, Shielded Drum Core, Ferrite, 10 µH, 1.2 A, 0.124 ohm, SMD	CDRH5D18	CDRH5D18NP-100NC	Sumida		
R32, R33, R35, R36	0	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale		
R40	0	681	RES, 681, 1%, 0.1 W, 0603	0603	CRCW0603681RFKEA	Vishay-Dale		
R41	0	9.31k	RES, 9.31k, 1%, 0.1 W, 0603	0603	CRCW06039K31FKEA	Vishay-Dale		
R42, R54, R95	0	10.0k	RES, 10.0k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale		
R43	0	3.01k	RES, 3.01k, 1%, 0.1 W, 0603	0603	CRCW06033K01FKEA	Vishay-Dale		
R44	0	158k	RES, 158k, 1%, 0.1 W, 0603	0603	CRCW0603158KFKEA	Vishay-Dale		
R45	0	453k	RES, 453k, 1%, 0.1 W, 0603	0603	CRCW0603453KFKEA	Vishay-Dale		
R46	0	51.1k	RES, 51.1k, 1%, 0.1 W, 0603	0603	CRCW060351K1FKEA	Vishay-Dale		
R47	0	49.9k	RES, 49.9k, 1%, 0.1 W, 0603	0603	CRCW060349K9FKEA	Vishay-Dale		
R48	0	15.0k	RES, 15.0k, 1%, 0.1 W, 0603	0603	CRCW060315K0FKEA	Vishay-Dale		
R49	0	121k	RES, 121k, 1%, 0.1 W, 0603	0603	CRCW0603121KFKEA	Vishay-Dale		
R50	0	10.0	RES, 10.0, 1%, 0.1 W, 0603	0603	CRCW060310R0FKEA	Vishay-Dale		
R51	0	100k	RES, 100k, 1%, 0.1 W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale		
R52	0	1.30Meg	RES, 1.30M, 1%, 0.1 W, 0603	0603	CRCW06031M30FKEA	Vishay-Dale		
R53	0	93.1k	RES, 93.1k, 1%, 0.1 W, 0603	0603	CRCW060393K1FKEA	Vishay-Dale		
R59, R64, R65, R87	0	1.00Meg	RES, 1.00M, 1%, 0.1 W, 0603	0603	CRCW06031M00FKEA	Vishay-Dale		
R72, R73, R83, R85, R86, R92, R96	0	0	RES, 0, 5%, 0.125 W, 0603	0603	MCT06030Z0000ZP500	Vishay/Beyschlag		
R93	0	1.00k	RES, 1.00k, 0.1%, 0.1 W, 0603	0603	RT0603BRB071KL	Yageo America		
R94, R97	0	0.22	RES, 0.22, 1%, 0.1 W, 0603	0603	ERJ-3RQFR22V	Panasonic		
SH-J4	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
U16	0		1.5-A LOW-NOISE FAST-TRANSIENT-RESPONSE LOW-DROPOUT REGULATOR, DCQ0006A	DCQ0006A	TL1963ADCQR	Texas Instruments	TL1963ADCQT	Texas Instruments
U17	0		3-PIN VOLTAGE SUPERVISORS, DBV0003A	DBV0003A	TPS3809I50QDBVRQ1	Texas Instruments		Texas Instruments
U18	0		Single Inverter Buffer/Driver With Open-Drain Output, DCK0005A	DCK0005A	SN74LVC1G06DCKR	Texas Instruments	SN74LVC1G06DCKT	Texas Instruments
U19	0		Step-Up DC-DC Converter with Forced PWM Mode, 2.3 to 6 V, -40 to 105 degC, 8-pin SOP (PW8), Green (RoHS & no Sb/Br)	PW0008A	TPS61085TPWR	Texas Instruments	Equivalent	Texas Instruments
U20	0		Single Output High PSRR LDO, 150 mA, Adjustable 1.2 to 33 V Output, 3 to 36 V Input, with Ultra-Low Noise, 8-pin MSOP (DGN), -40 to 125 degC, Green (RoHS & no Sb/Br)	DGN0008D	TPS7A4901DGNR	Texas Instruments	Equivalent	Texas Instruments
U21	0		DC-DC INVERTER, DRC0010J	DRC0010J	TPS63700DRCR	Texas Instruments	TPS63700DRCT	Texas Instruments
U22	0		Single Output High PSRR LDO, 200 mA, Adjustable -1.18 to -33 V Output, -3 to -36 V Input, with Ultra-Low Noise, 8-pin MSOP (DGN), -40 to 125 degC, Green (RoHS & no Sb/Br)	DGN0008D	TPS7A3001DGNR	Texas Instruments	Equivalent	Texas Instruments

Table 10. ADS127L01 Bill of Materials⁽¹⁾ (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
U31	0		36-V, Precision, Rail-to-Rail Input/Output, Low Offset Voltage, Low Input Bias Current Op Amp with e-trim, DBV0005A	DBV0005A	OPA192IDBVR	Texas Instruments	OPA192IDBVT	Texas Instruments
U33	0		Low-Noise, Very Low Drift, Precision VOLTAGE REFERENCE, DGK0008A	DGK0008A	REF5025IDGKR	Texas Instruments	REF5025IDGKT	Texas Instruments
U34	0		Precision, 20 MHz, 0.9 pA Ib, RRIO, CMOS Operational Amplifier, 1.8 to 5.5 V, -40 to 125 degC, 5-pin SOT23 (DBV0005A), Green (RoHS & no Sb/Br)	DBV0005A	OPA320AIDBVT	Texas Instruments	Equivalent	Texas Instruments

7.2 PCB Layout

Figure 18 through Figure 24 illustrate the PCB layout.

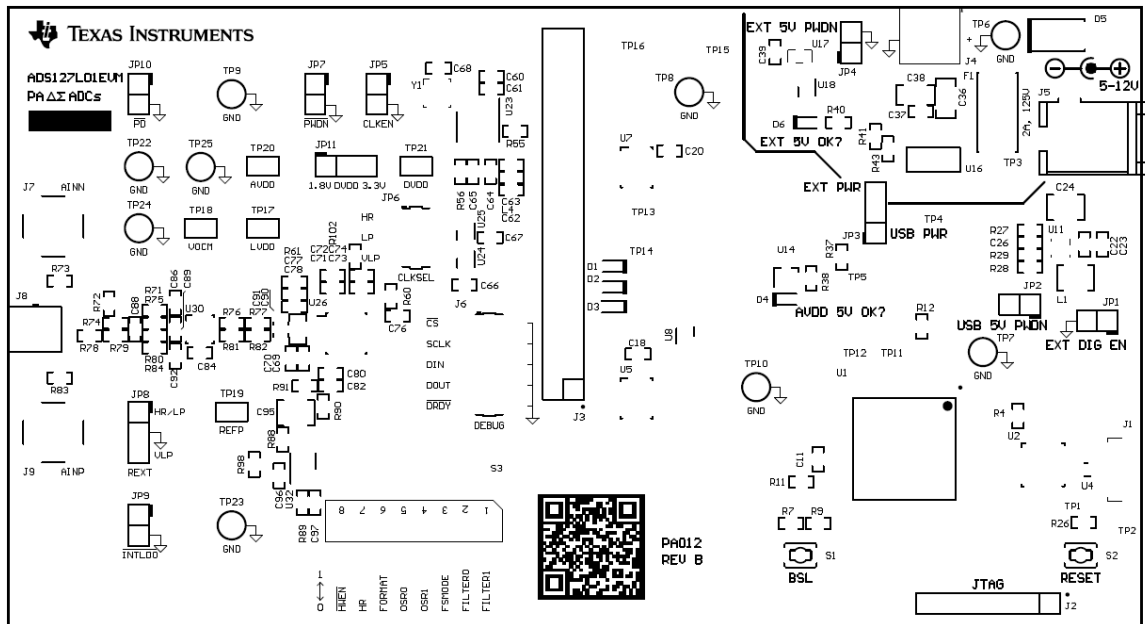


Figure 18. Top Silkscreen

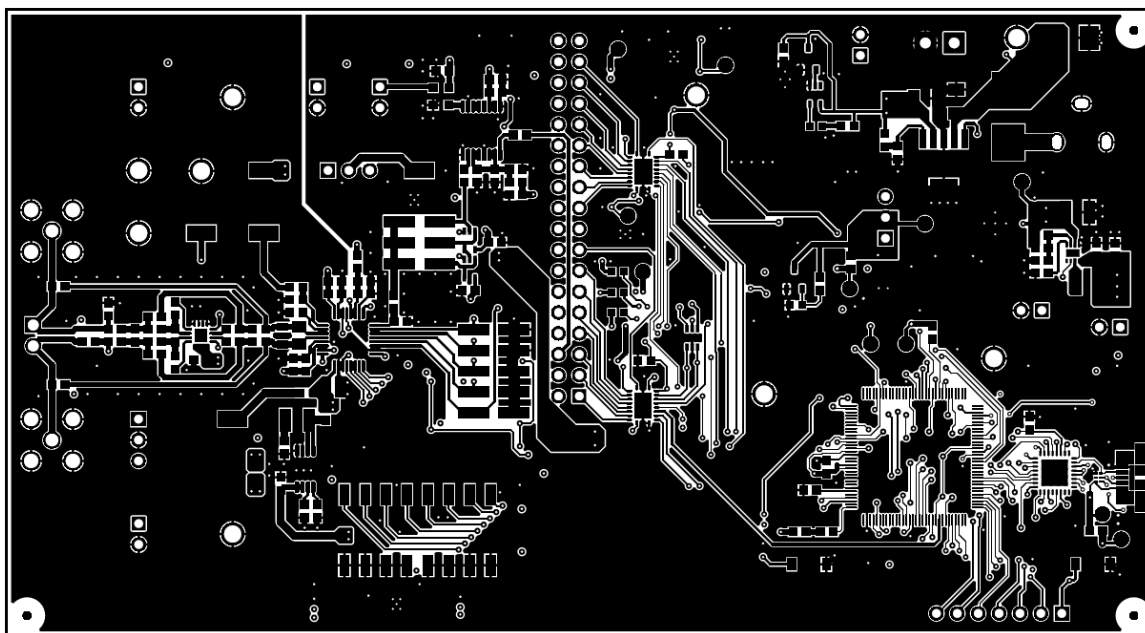


Figure 19. Top Layer (Positive)

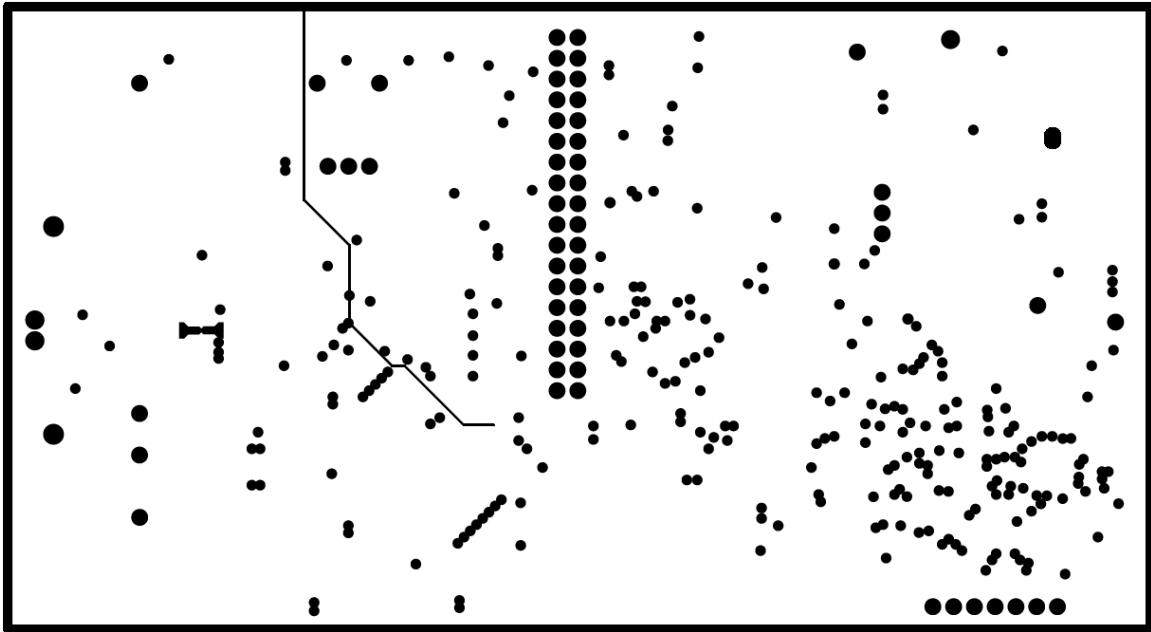


Figure 20. Ground (Negative)

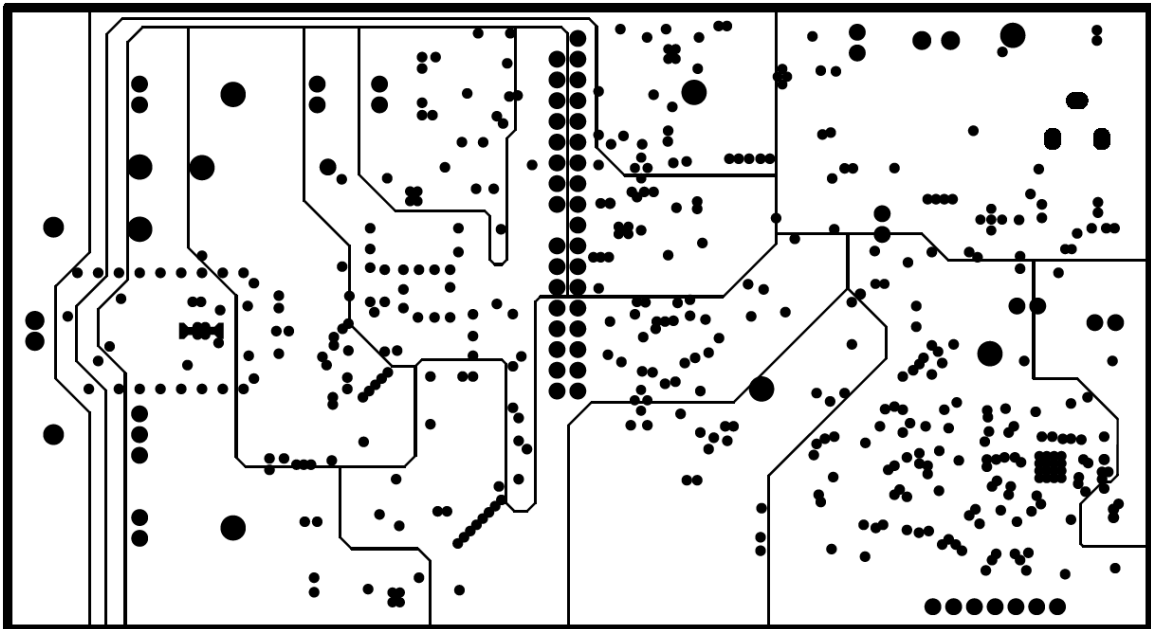


Figure 21. Power (Negative)

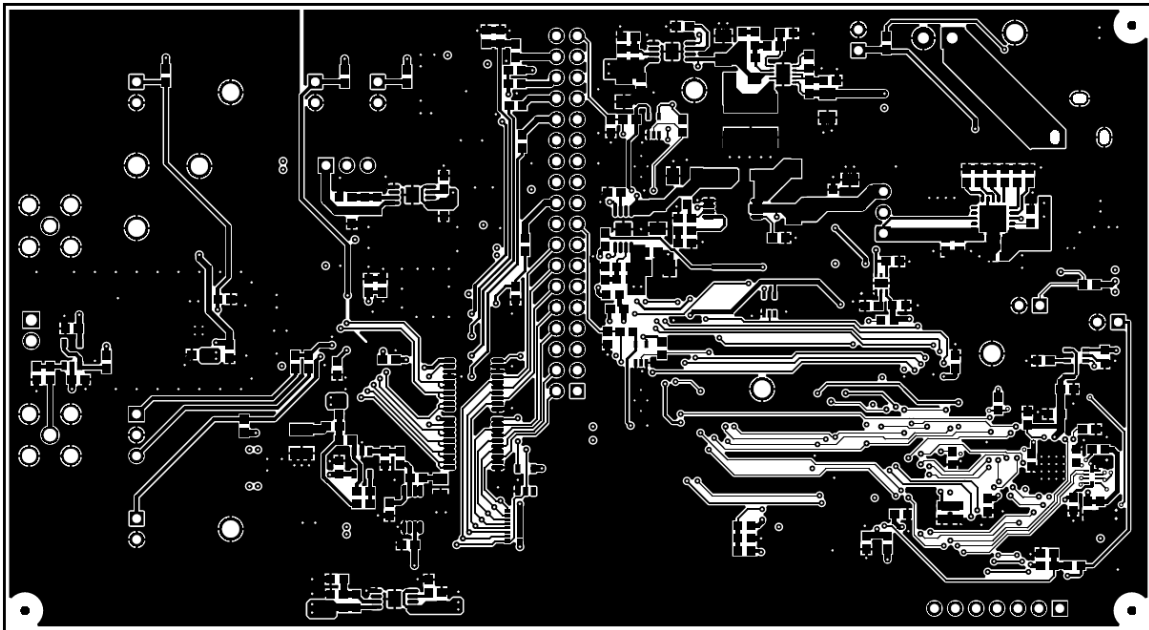


Figure 22. Bottom Layer (Positive)

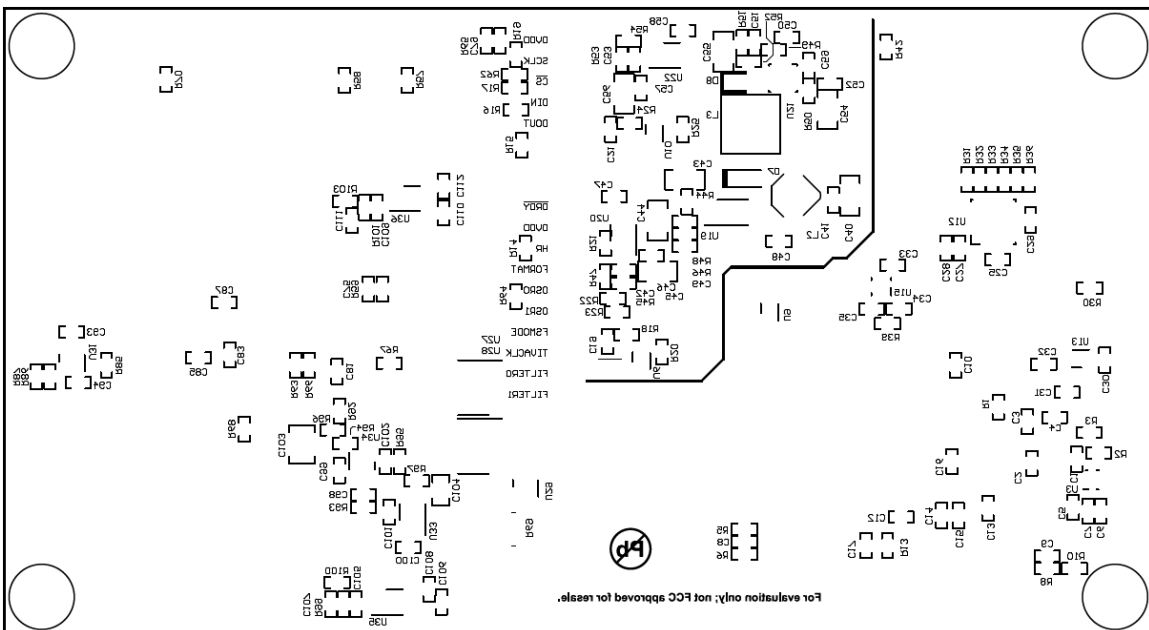


Figure 23. Bottom Silkscreen

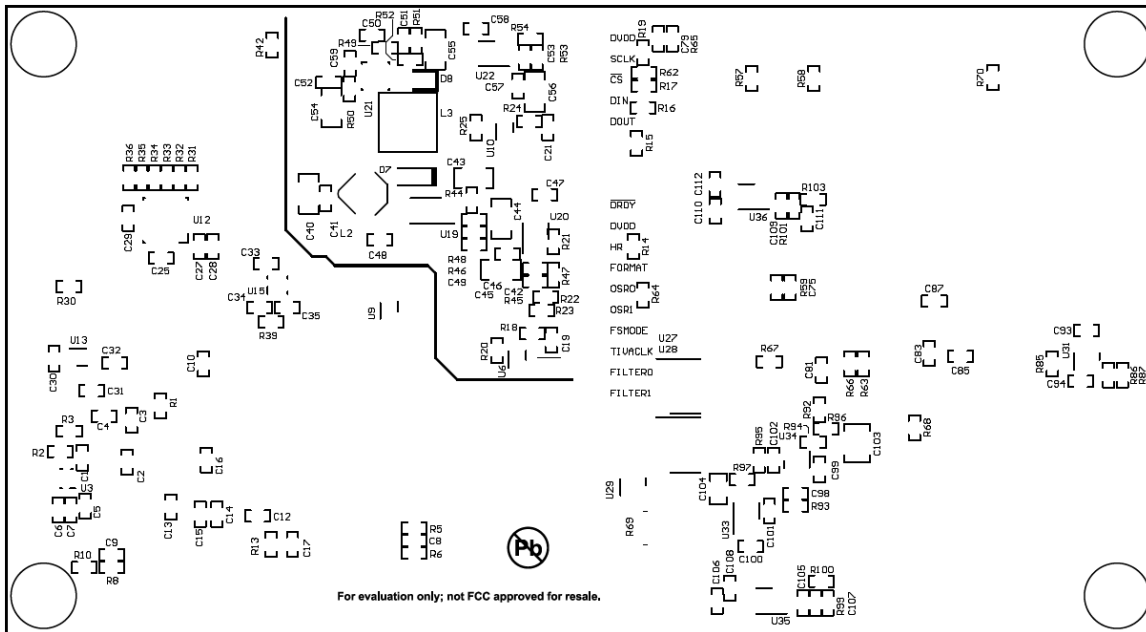
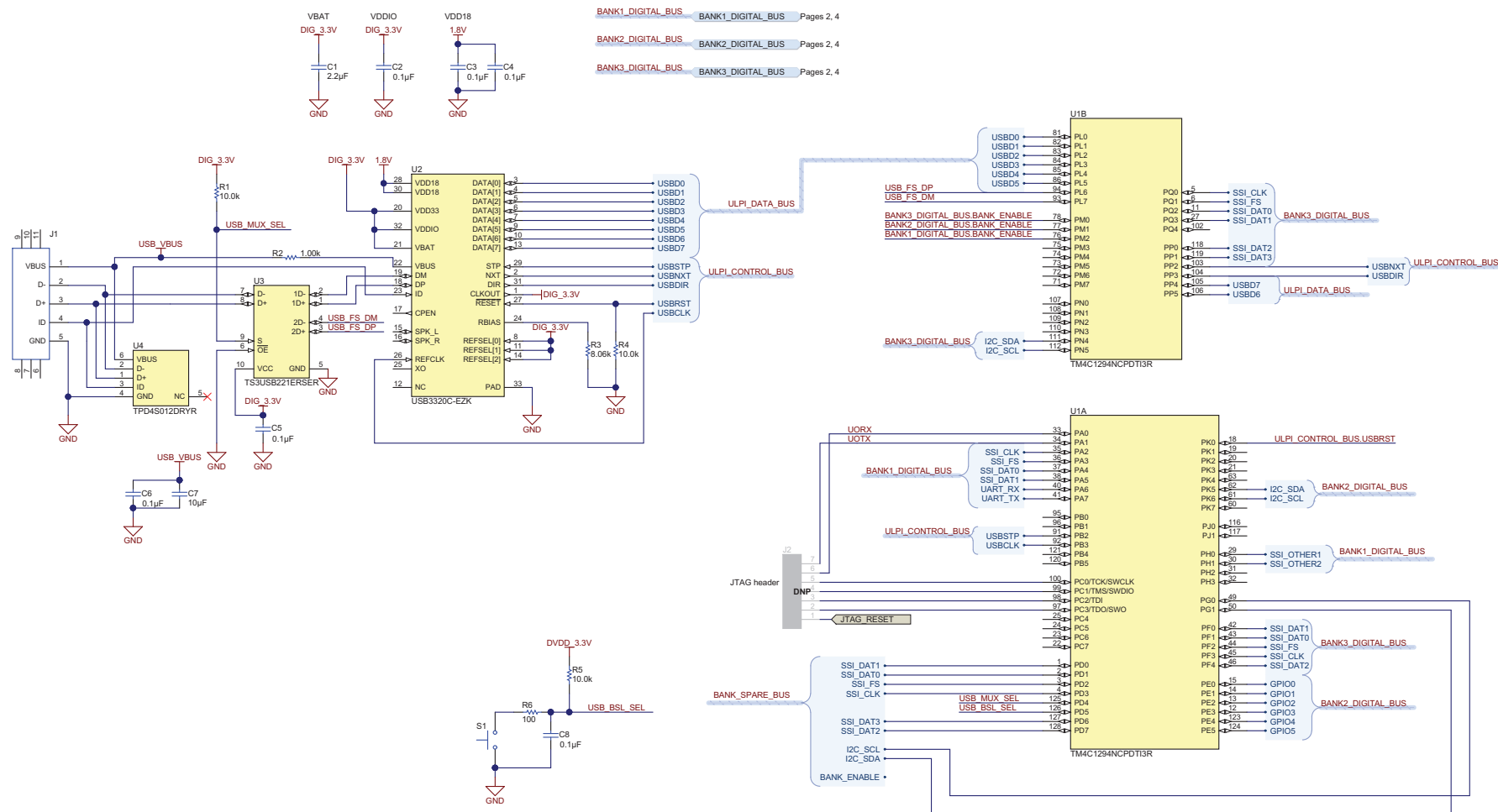


Figure 24. Bottom Silkscreen (Mirrored)

7.3 Schematic

Figure 25 through Figure 34 illustrate the EVM schematics.



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Figure 25. TM4C Main Schematic

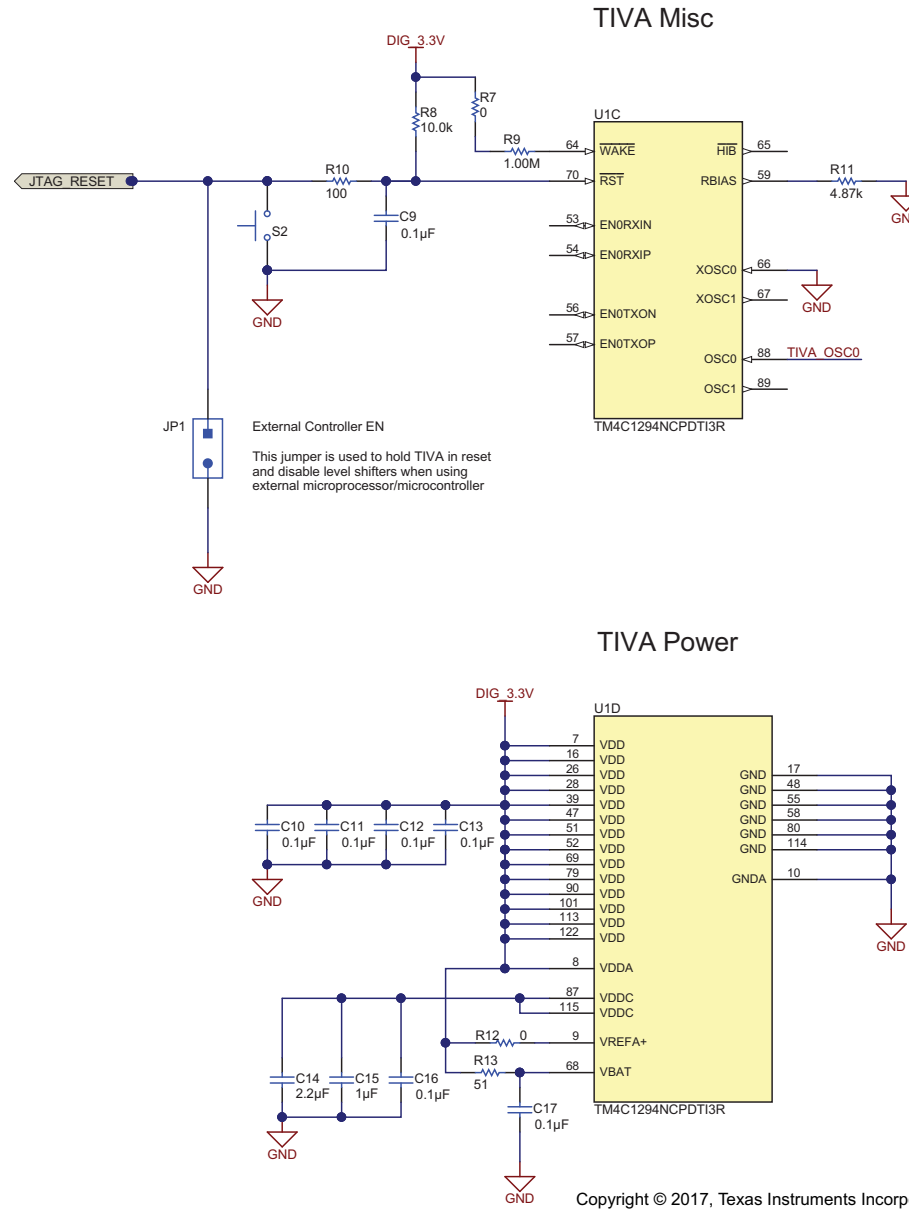


Figure 26. TM4C Miscellaneous and Power Schematic

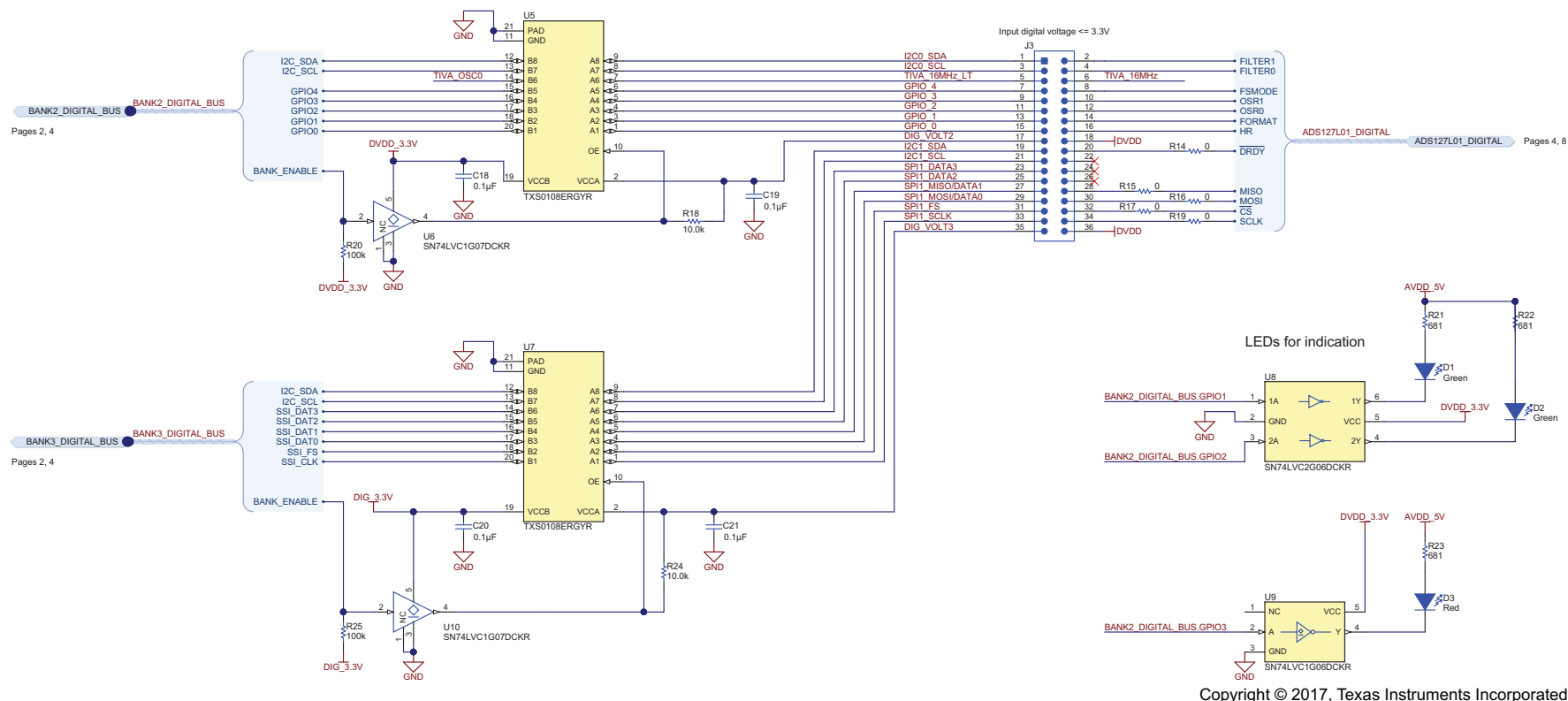


Figure 27. ADS127L01EVM Digital Header Schematic

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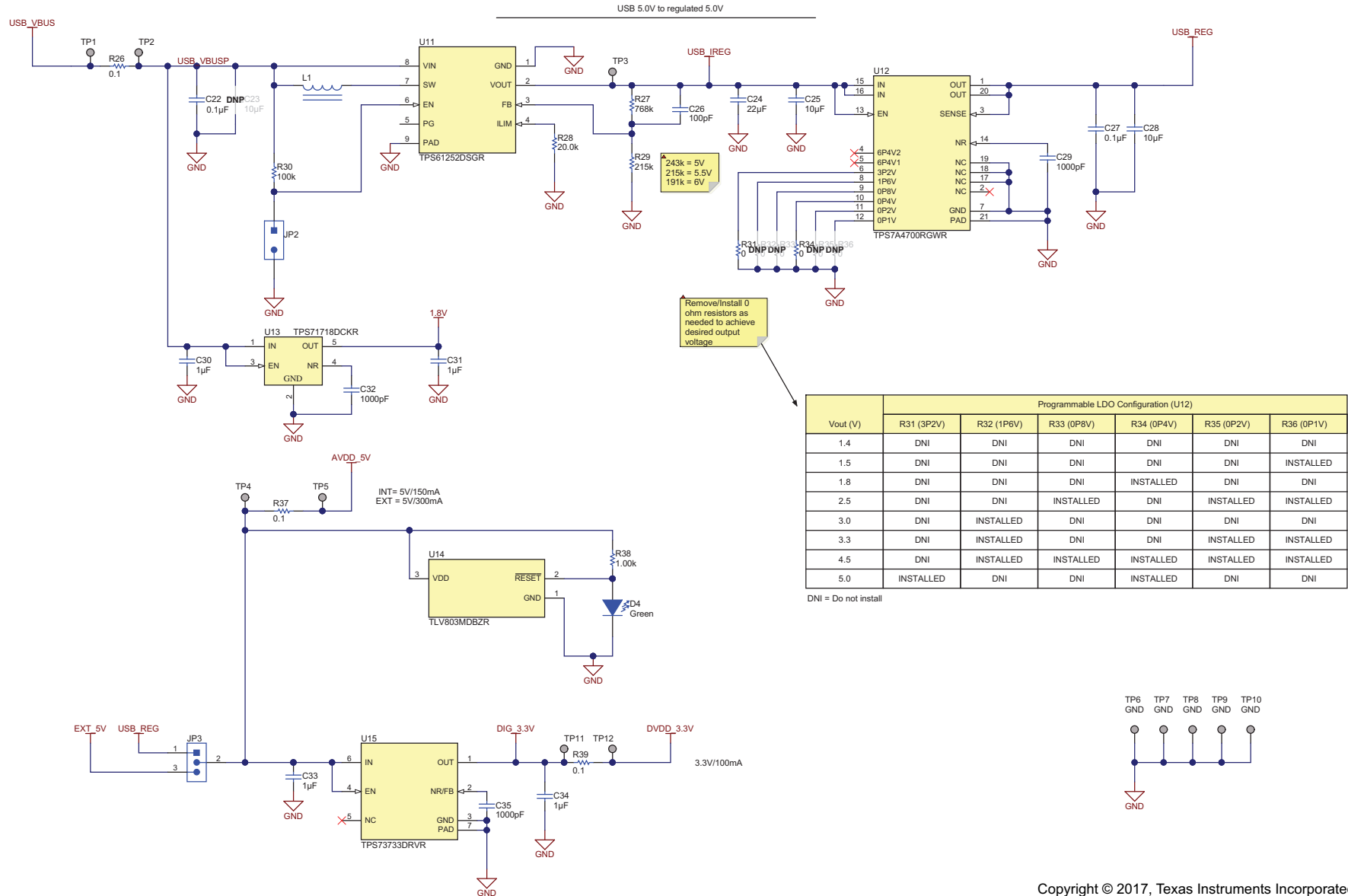


Figure 28. ADS127L01EVM USB Power Schematic

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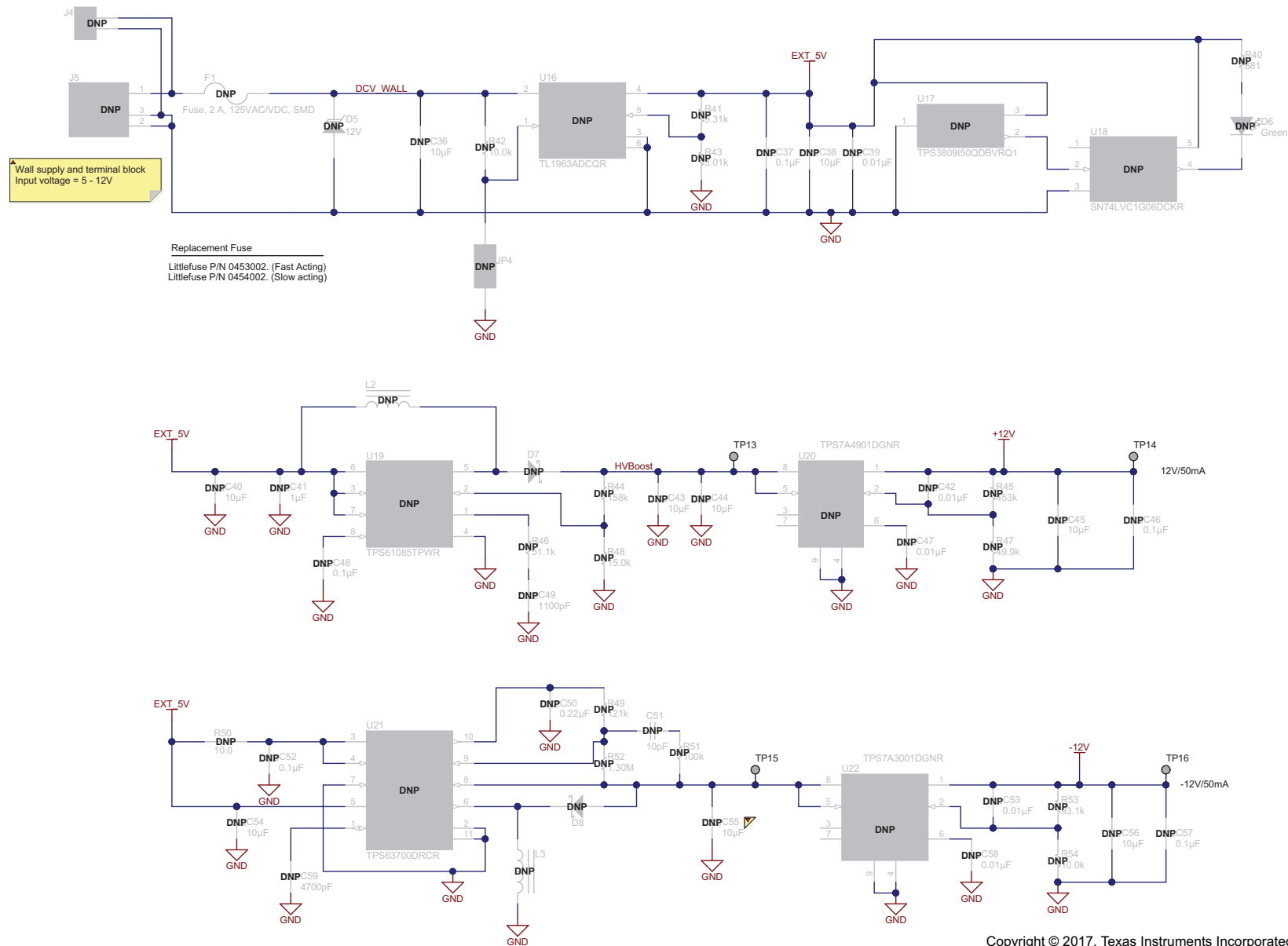


Figure 29. ADS127L01EVM External Power Schematic

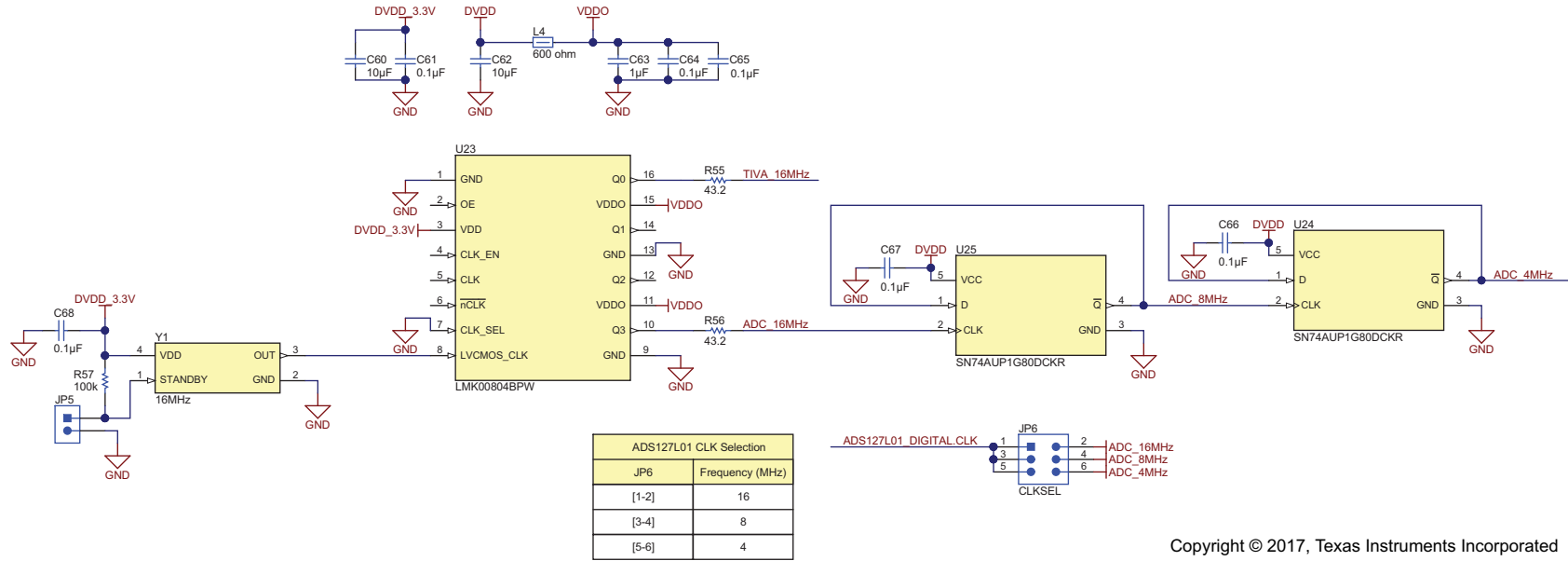
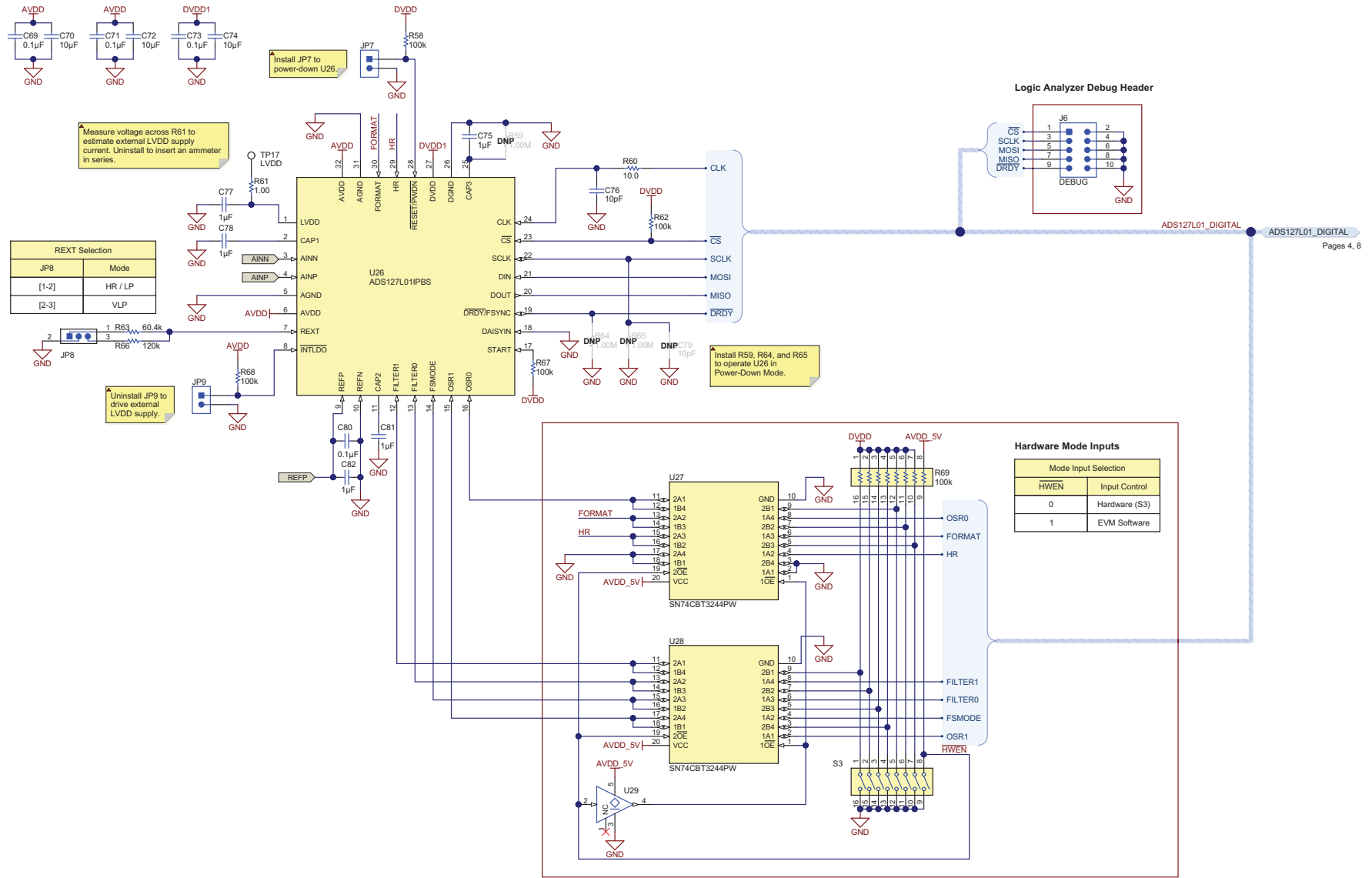


Figure 30. ADS127L01EVM Clock Tree Schematic

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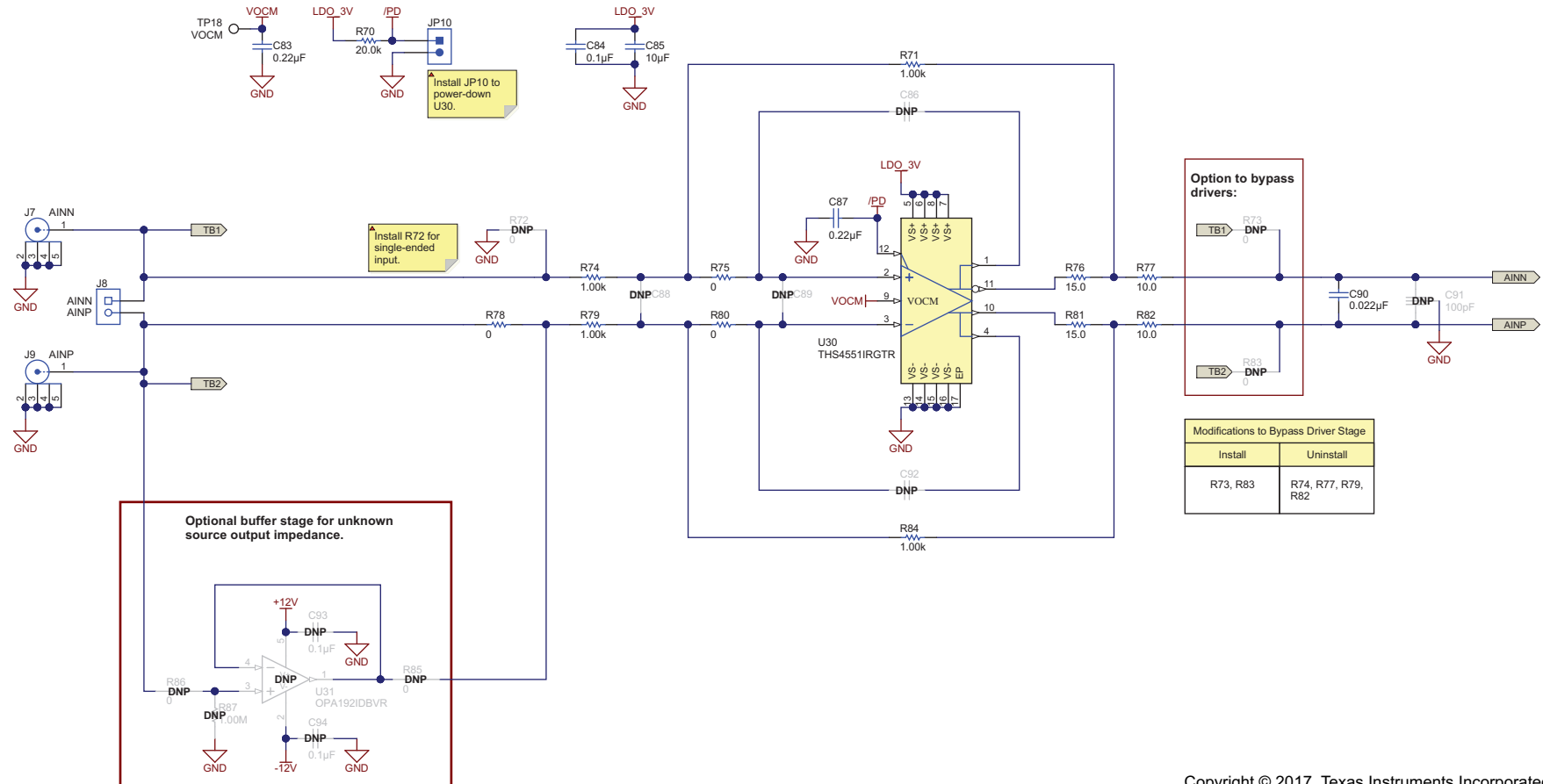


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Figure 31. ADS127L01EVM ADC Main Schematic

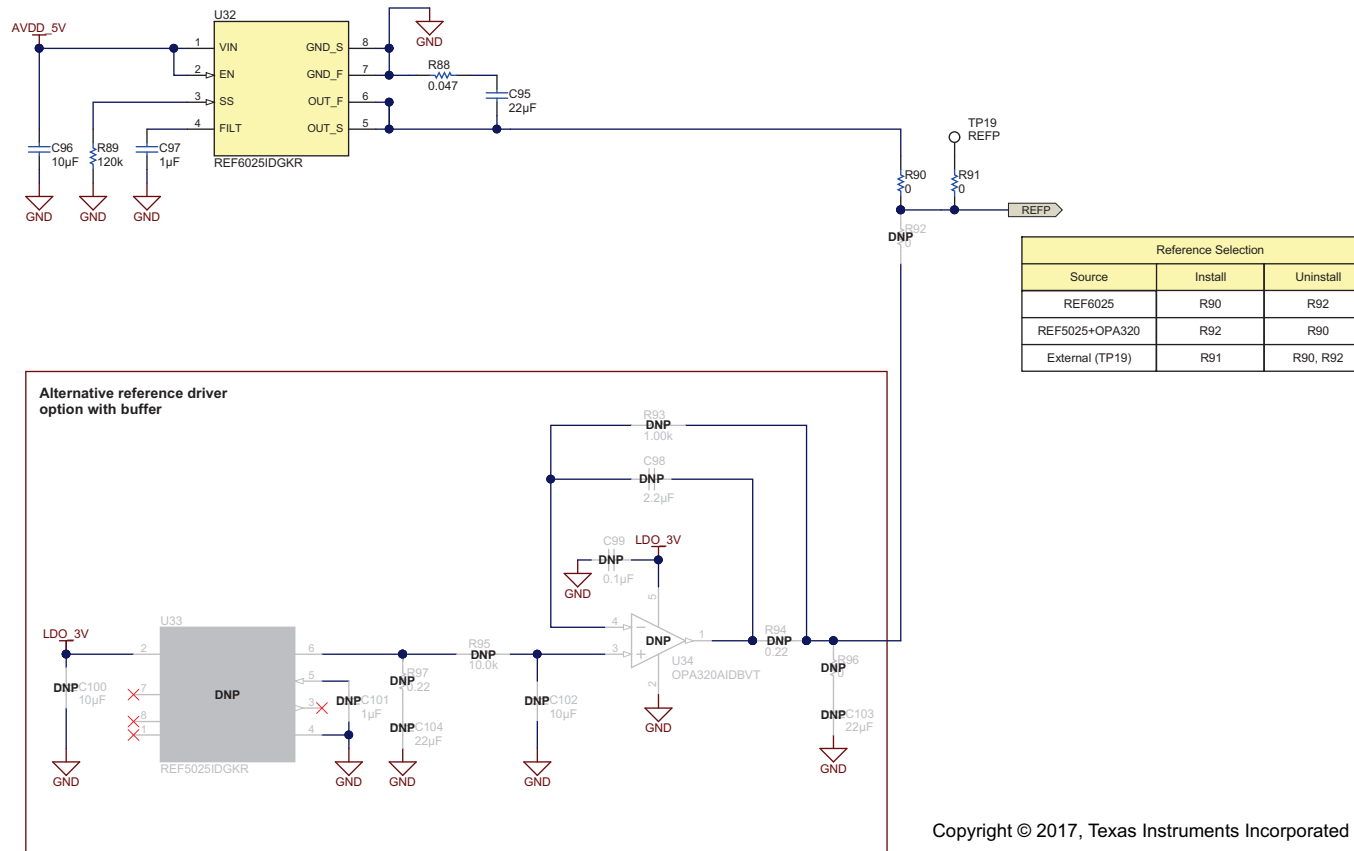
Alternate Driver Options				
U30	Gain Bandwidth Product (MHz)	Noise Density (nV/√Hz)	Quiescent Current Iq (mA)	Rf, Rg (Ω) (R71, R74, R79, R84)
THS4531A	36	10	0.23	2k
THS4551	135	3.3	1.31	1k
THS4541	850	2.2	9.7	402

Performance may vary with alternate drivers.



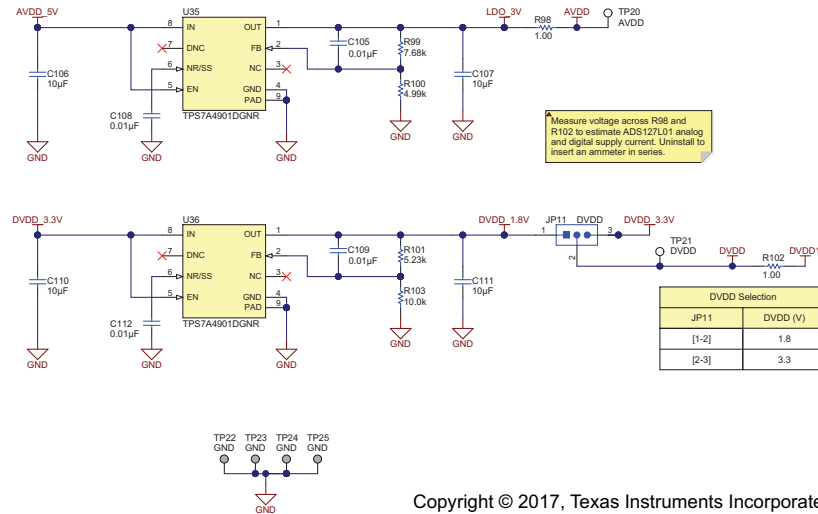
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Figure 32. ADS127L01EVM ADC Input Driver Schematic



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Figure 33. ADS127L01EVM ADC Reference Schematic



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Figure 34. ADS127L01EVM ADC Power Schematic

Revision History

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

Changes from A Revision (May 2016) to B Revision	Page
• Changed AGND to GND in the second to last bullet in the <i>Supported Hardware Functionality</i> section.	4
• Updated contents of the <i>Default Settings</i> table.	5
• Updated contents of the <i>Hardware Item Descriptions</i> table.	7
• Changed <i>Input Common-Mode Voltage</i> and <i>System Ground</i> rows in the <i>Test Points, TP17 – TP24</i> table.	8
• Changed <i>Digital Interface Header, J3</i> table.	9
• Updated <i>Debug Header, J6</i> table.	9
• Added <i>SPI Commands</i> section.	14
• Changed most of the <i>ADS127L01EVM Hardware</i> section.	15
• Updated <i>Power Supply Connections</i> section.	19
• Changed BOM in the <i>Bill of Materials</i> section.	20
• Changed all schematics in the <i>Schematic</i> section.	30
• Added <i>ADS127L01EVM Clock Tree Schematic</i> image.	35

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 - 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 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 a nonconforming EVM if (a) the nonconformity was 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, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, 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:*

FCC NOTICE: 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 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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/lstds/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/lstds/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 to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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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