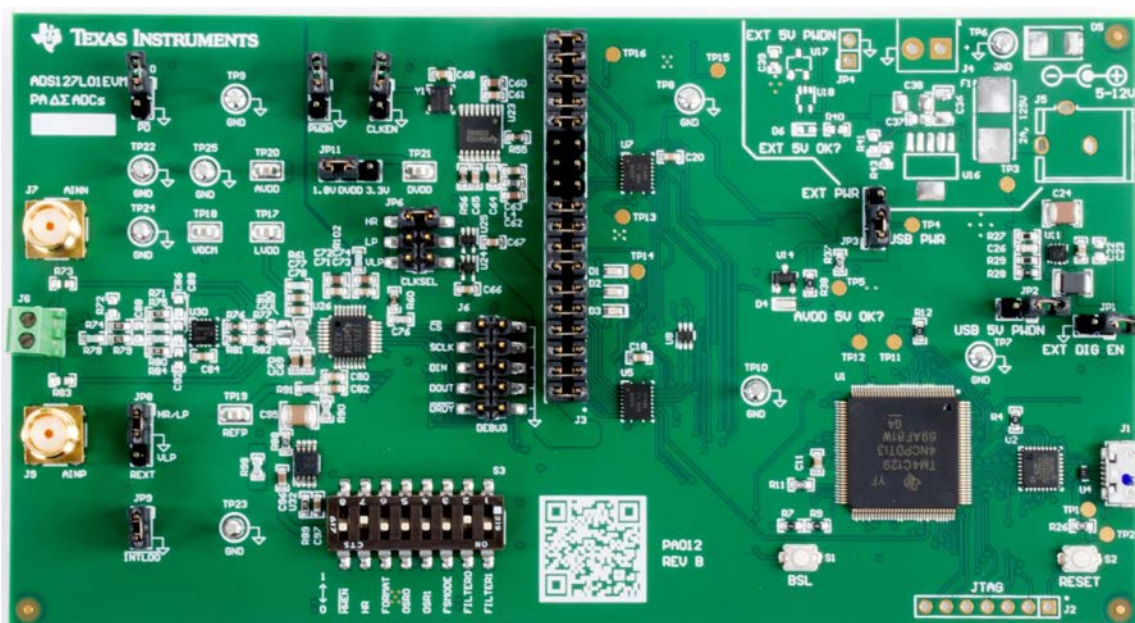


## ADS127L01EVM



**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       |
|---------------------------|-------------------------|
| <a href="#">ADS127L01</a> | <a href="#">SBAS607</a> |

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## 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.

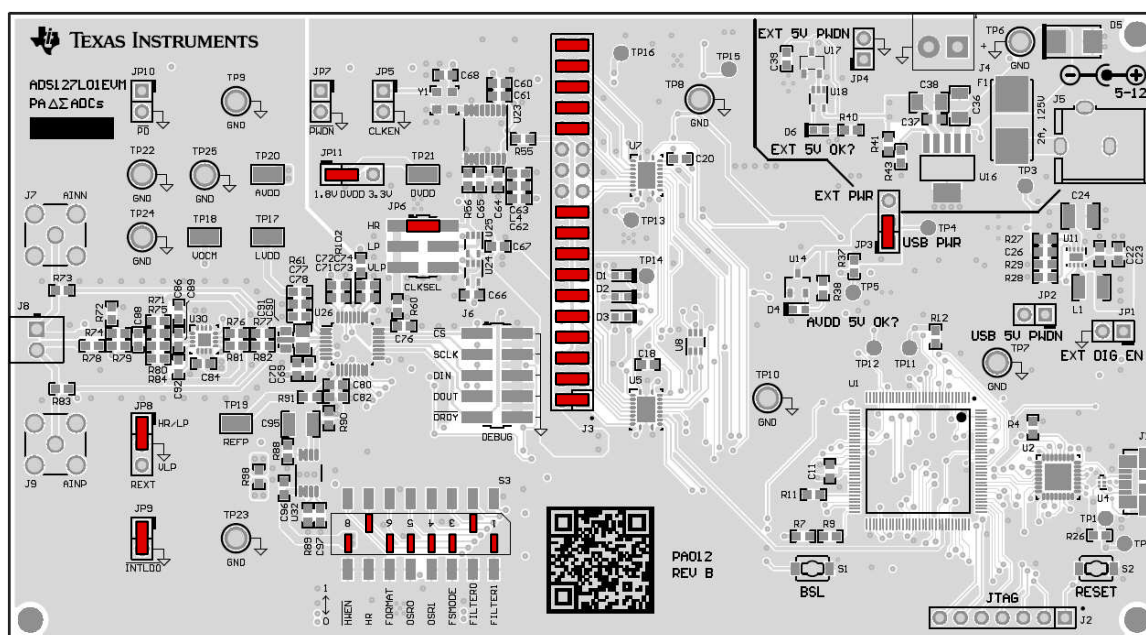
### 2.1 Default Jumper and Switch Configuration

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 <sub>EXT</sub> = 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 $\overline{\text{RST}}$ pulled high                                                                                                                                |
| S3     | HR = 1<br>FORMAT = 0<br>OSR [1:0] = 00<br>FSMODE = 0 <sup>(1)</sup><br>FILTER [1:0] = 01 | High-resolution mode<br>SPI mode<br>OSR = 32<br>Frame-sync slave mode <sup>(1)</sup><br>Wideband 2 filter (transition: 0.4 F <sub>DATA</sub> to 0.5 F <sub>DATA</sub> ) |

<sup>(1)</sup> 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 $\overline{\text{RST}}$ )        |                                                                                            |
|        | 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 ( $\overline{\text{CLKEN}}$ )         |                                                                                            |
|        | 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> ( $\overline{\text{RESET/PWDN}}$ ) |                                                                                            |
|        | Installed                                                                    | ADS127L01 held in <i>Power-Down Mode</i>                                                   |
|        | Uninstalled                                                                  | Normal operation                                                                           |
| JP8    | Select R <sub>EXT</sub> pull-down resistor (U26 REXT)                        |                                                                                            |
|        | 1-2                                                                          | 60.4 k $\Omega$ (HR and LP Mode)                                                           |
|        | 2-3                                                                          | 120 k $\Omega$ (VLP Mode)                                                                  |
| JP9    | Select source for ADS127L01 LVDD supply (U26 $\overline{\text{INTLDO}}$ )    |                                                                                            |
|        | 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 $\overline{\text{PD}}$ )              |                                                                                            |
|        | 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 $\overline{\text{RST}}$ )                 |                                                                                            |
|        | Closed                                                                       | Tiva held in RESET                                                                         |
|        | Open                                                                         | Normal operation                                                                           |

**Table 3. Hardware Item Descriptions (continued)**

| Switch | Position                    | Description |
|--------|-----------------------------|-------------|
| S3     | <i>Hardware Mode</i> 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            | $0.55\text{ V} \leq \text{V}_{\text{OCM}} \leq 1.8\text{ V}$ |
| ADC Reference Voltage     | REFP        | TP19            | $0.5\text{ V} \leq \text{V}_{\text{REF}} \leq 3.0\text{ V}$  |
| 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 <sup>(1)</sup> | Pin Number <sup>(2)</sup> | Signal Name              |
| GPIO Inputs for ADC<br><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                        | $\overline{\text{DRDY}}$ |
| SPI Port                                         | SPI1_MISO/DATA1 | 27                        | 28                        | MISO                     |
|                                                  | SPI1_MOSI/DATA0 | 29                        | 30                        | MOSI                     |
|                                                  | SPI1_FS         | 31                        | 32                        | $\overline{\text{CS}}$   |
|                                                  | SPI1_SCLK       | 33                        | 34                        | SCLK                     |
| IOVDD Supply for Level Translator (U7)           | DIG_VOLT3       | 35                        | 36                        | DVDD                     |

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

<sup>(2)</sup> 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 <sup>(1)</sup> |
|----------------------------------------------------------|--------------------------|---------------------------|
| Digital Signals for Logic Analyzer or External Processor | $\overline{\text{CS}}$   | 1                         |
|                                                          | SCLK                     | 3                         |
|                                                          | DIN                      | 5                         |
|                                                          | DOUT                     | 7                         |
|                                                          | $\overline{\text{DRDY}}$ | 9                         |

<sup>(1)</sup> 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 ADC 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.

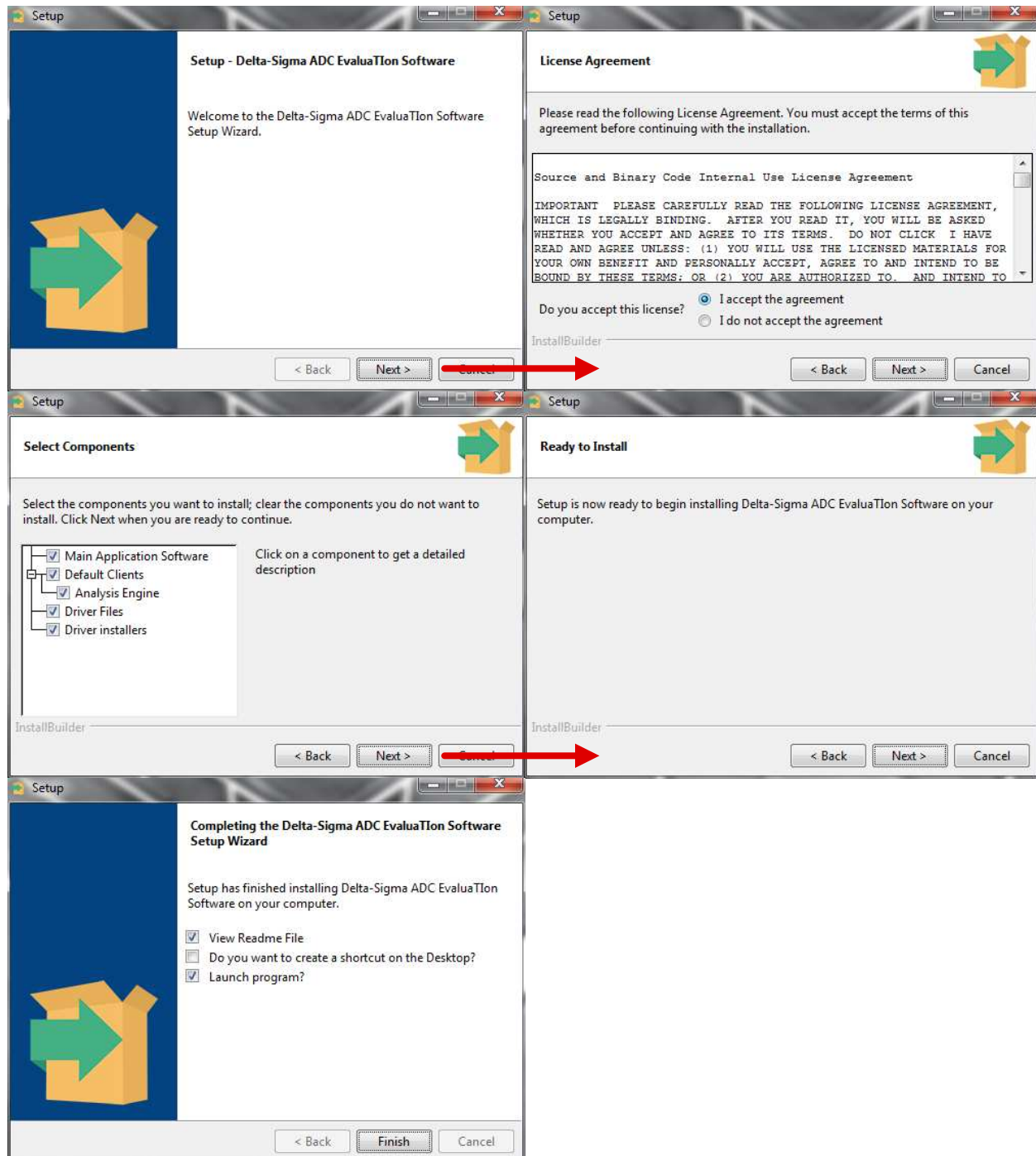


Figure 3. Delta-Sigma ADC Evaluation Software Installation Instructions

### 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.

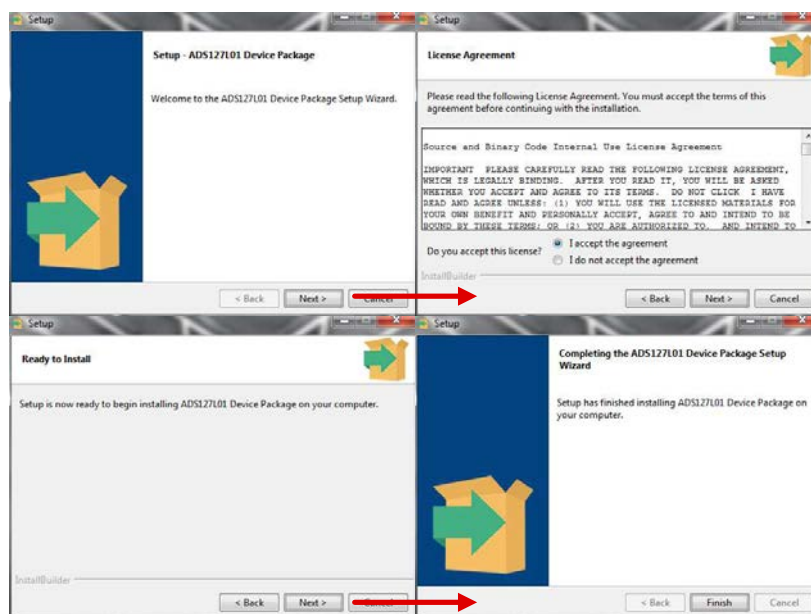


Figure 4. ADS127L01 Device Package Installation Instructions

## 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](#)).

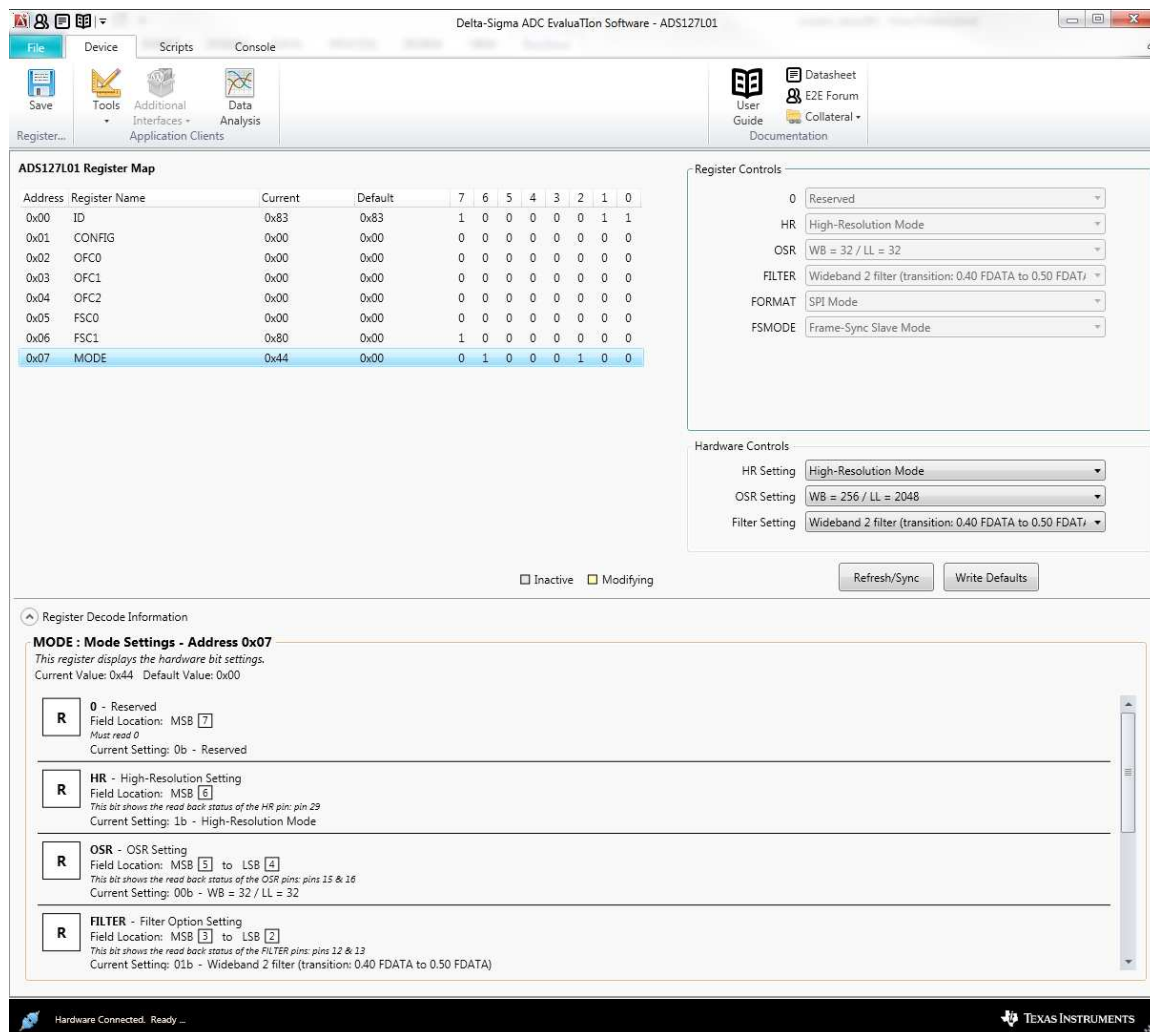


Figure 5. ADS127L01 Device Tab and Register Map

### 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.

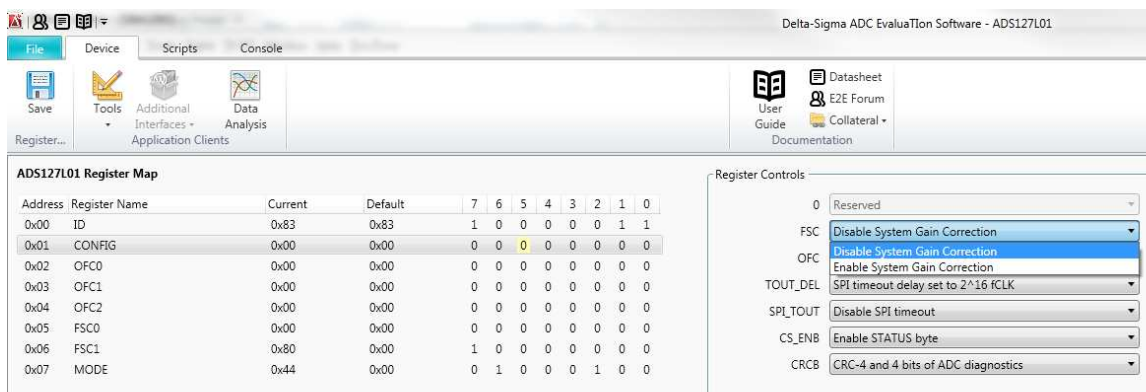


Figure 6. Register Controls for the ADS127L01

### 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.

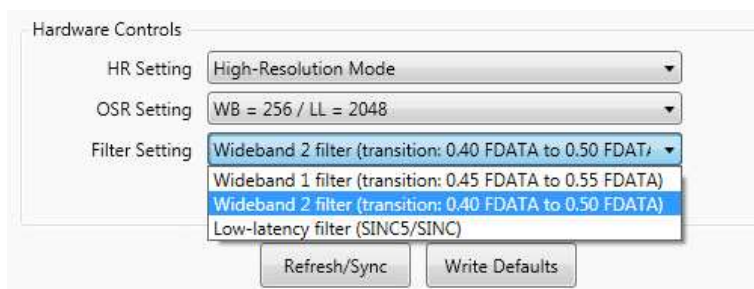


Figure 7. Hardware Controls for the ADS127L01 Mode Pins

### 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                                                               |
|---------------------------------|-----------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Basic GUI Commands</b>       |                                         |                                                       |                                                                           |
| 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                            |
| <b>Device Firmware Commands</b> |                                         |                                                       |                                                                           |
| RESET                           | RESET                                   |                                                       | Reset the device to power-on values                                       |
| START <sup>(1)</sup>            | START                                   |                                                       | Start/restart (synchronize) conversions                                   |
| STOP <sup>(1)</sup>             | STOP                                    |                                                       | Stop conversions                                                          |
| RDATA <sup>(2)</sup>            | RDATA                                   |                                                       | Read data by command                                                      |
| RREG                            | RREG <rr> <nn>                          | rr: 00h to 07h<br>nn: 00h to 07h                      | Read (nn + 1) registers starting at address rr                            |
| WREG                            | WREG <rr> <nn> <value 0> ... <value nn> | rr: 00h to 07h<br>nn: 00h to 07h<br>value: 00h to FFh | Write (nn + 1) registers starting at address rr                           |
| <b>EVM Firmware Commands</b>    |                                         |                                                       |                                                                           |
| 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 |

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

<sup>(2)</sup> 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  $\overline{CS\_ENB} = 1$ .

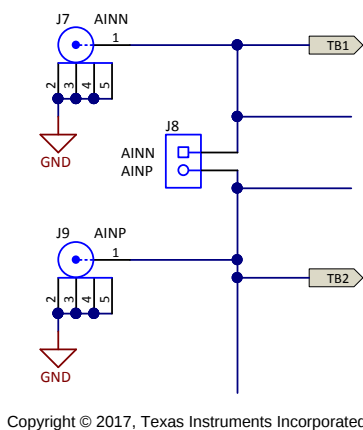
## 5 ADS127L01EVM Hardware

### 5.1 Analog Inputs

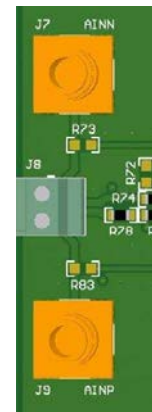
Analog input signals can be connected through the SMA connectors (J7 and J9) or through the terminal block (J8).

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.



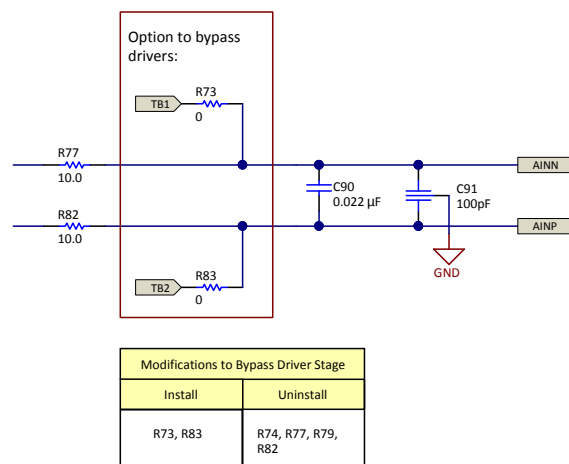
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**Figure 8. Analog Input Connections (Schematic)**

**Figure 9. Analog Input Connections (PCB)**

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.



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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 $\Omega$ , 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.

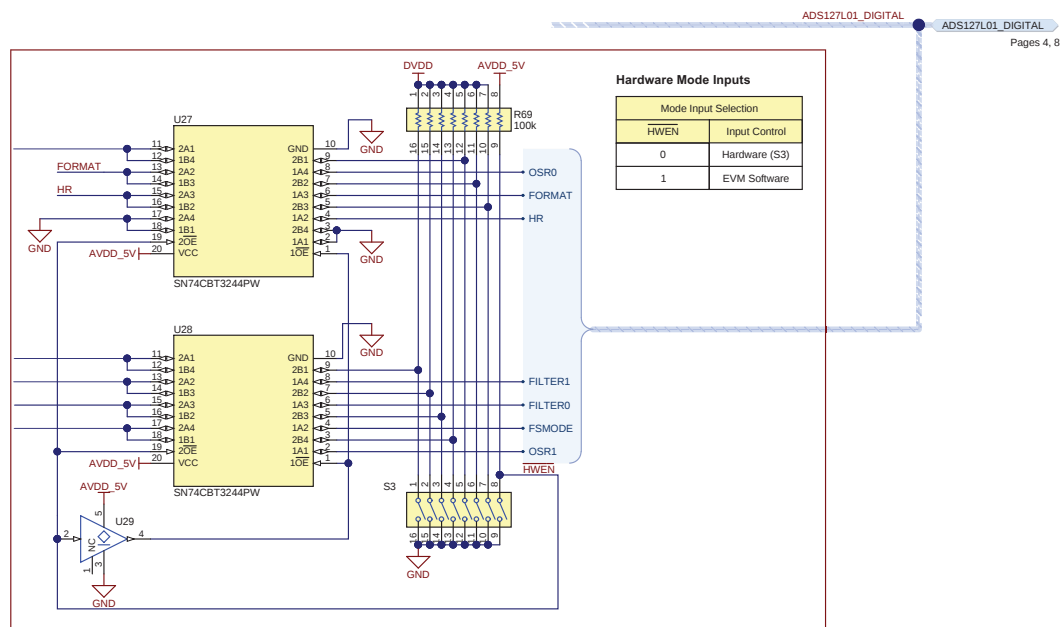


Figure 11. Hardware Mode Input Controls (Schematic)

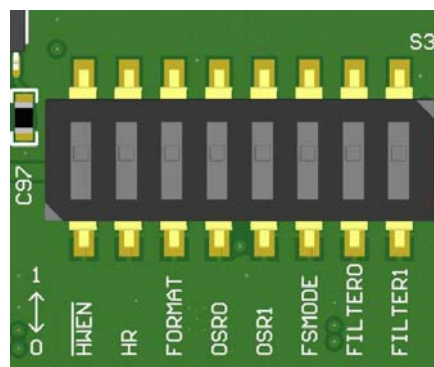


Figure 12. Hardware Mode Input Controls (PCB)

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.

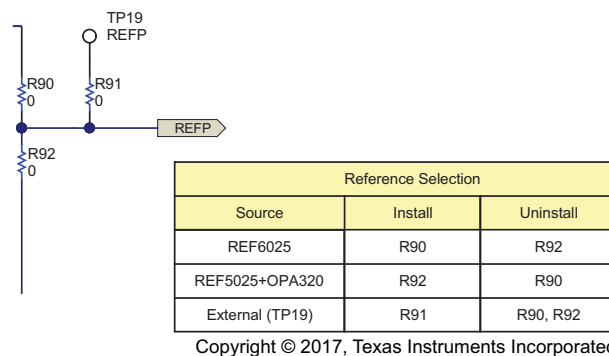


Figure 13. Reference Input Selection

### 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.

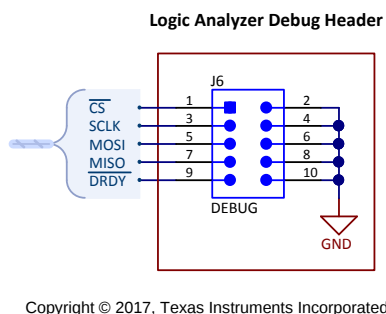


Figure 14. Debug Header for Logic Analyzer (Schematic)

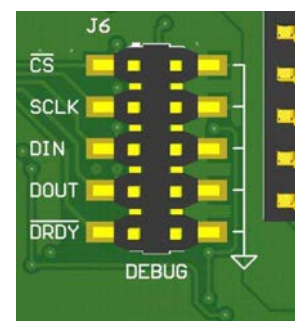


Figure 15. Debug Header for Logic Analyzer (PCB)

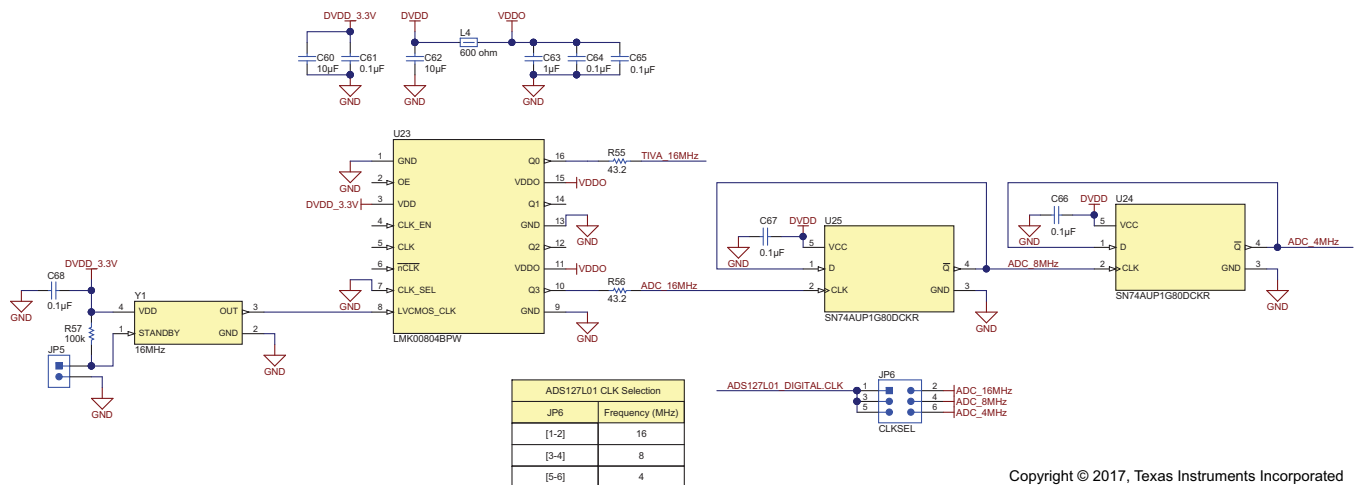
The START pin on the ADS127L01 is tied to DVDD through a 100-kΩ pullup resistor (R67) by default. The low side of R67 can be soldered to a GND connection with a jumper wire to allow for external control of the ADS127L01 conversions via the START and STOP SPI commands.

## 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)

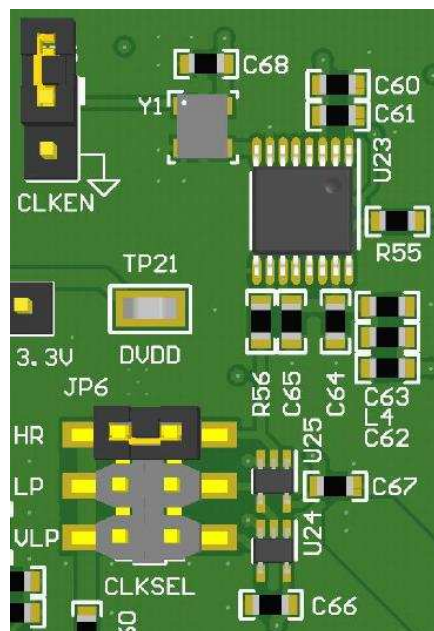


Figure 17. Clock Tree (PCB)

## 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  $\pm 12$ -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  $\Omega$ ). 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  $\Omega$ ) 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<sup>(1)</sup>**

| 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 $\mu$ 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 $\mu$ 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 $\mu$ 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 $\mu$ F, 50 V, +/- 10%, X7R, 0603                 | 0603                                      | UMK107AB7105KA-T   | Taiyo Yuden         |                       |                        |
| C24                                                                                                                                           | 1   | 22uF    | CAP, CERM, 22 $\mu$ 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 $\mu$ F, 25 V, +/- 10%, X7R, 0603              | 0603                                      | GRM188R71E224KA88D | Murata              |                       |                        |
| C90                                                                                                                                           | 1   | 0.022uF | CAP, CERM, 0.022 $\mu$ F, 50 V, +/- 5%, C0G/NP0, 0805          | 0805                                      | GRM21B5C1H223JA01L | Murata              |                       |                        |
| C95                                                                                                                                           | 1   | 22uF    | CAP, CERM, 22 $\mu$ F, 25 V, +/- 10%, X7R, 1210                | 1210                                      | GRM32ER71E226KE15L | Murata              |                       |                        |
| C105, C108, C109, C112                                                                                                                        | 4   | 0.01uF  | CAP, CERM, 0.01 $\mu$ 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              |                       |                        |

<sup>(1)</sup> 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<sup>(1)</sup> (continued)**

| Designator                                       | Qty | Value   | Description                                                      | Package Reference             | Part Number        | Manufacturer                    | Alternate Part Number | Alternate Manufacturer |
|--------------------------------------------------|-----|---------|------------------------------------------------------------------|-------------------------------|--------------------|---------------------------------|-----------------------|------------------------|
| L1                                               | 1   | 1uH     | Inductor, Wirewound, Ferrite, 1 $\mu$ H, 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                          | MCT0603020000ZP500 | 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<sup>(1)</sup> (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<sup>(1)</sup> (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<sup>(1)</sup> (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, 9.31 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW06039K31FKEA   | Vishay-Dale       |                       |                        |
| R42, R54, R95                     | 0   | 10.0k   | RES, 10.0 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW060310K0FKEA   | Vishay-Dale       |                       |                        |
| R43                               | 0   | 3.01k   | RES, 3.01 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW06033K01FKEA   | Vishay-Dale       |                       |                        |
| R44                               | 0   | 158k    | RES, 158 k, 1%, 0.1 W, 0603                                                                                                                                                | 0603              | CRCW0603158KFKEA   | Vishay-Dale       |                       |                        |
| R45                               | 0   | 453k    | RES, 453 k, 1%, 0.1 W, 0603                                                                                                                                                | 0603              | CRCW0603453KFKEA   | Vishay-Dale       |                       |                        |
| R46                               | 0   | 51.1k   | RES, 51.1 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW060351K1FKEA   | Vishay-Dale       |                       |                        |
| R47                               | 0   | 49.9k   | RES, 49.9 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW060349K9FKEA   | Vishay-Dale       |                       |                        |
| R48                               | 0   | 15.0k   | RES, 15.0 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW060315K0FKEA   | Vishay-Dale       |                       |                        |
| R49                               | 0   | 121k    | RES, 121 k, 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, 100 k, 1%, 0.1 W, 0603                                                                                                                                                | 0603              | CRCW0603100KFKEA   | Vishay-Dale       |                       |                        |
| R52                               | 0   | 1.30Meg | RES, 1.30 M, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW06031M30FKEA   | Vishay-Dale       |                       |                        |
| R53                               | 0   | 93.1k   | RES, 93.1 k, 1%, 0.1 W, 0603                                                                                                                                               | 0603              | CRCW060393K1FKEA   | Vishay-Dale       |                       |                        |
| R59, R64, R65, R87                | 0   | 1.00Meg | RES, 1.00 M, 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, 1.00 k, 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<sup>(1)</sup> (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.

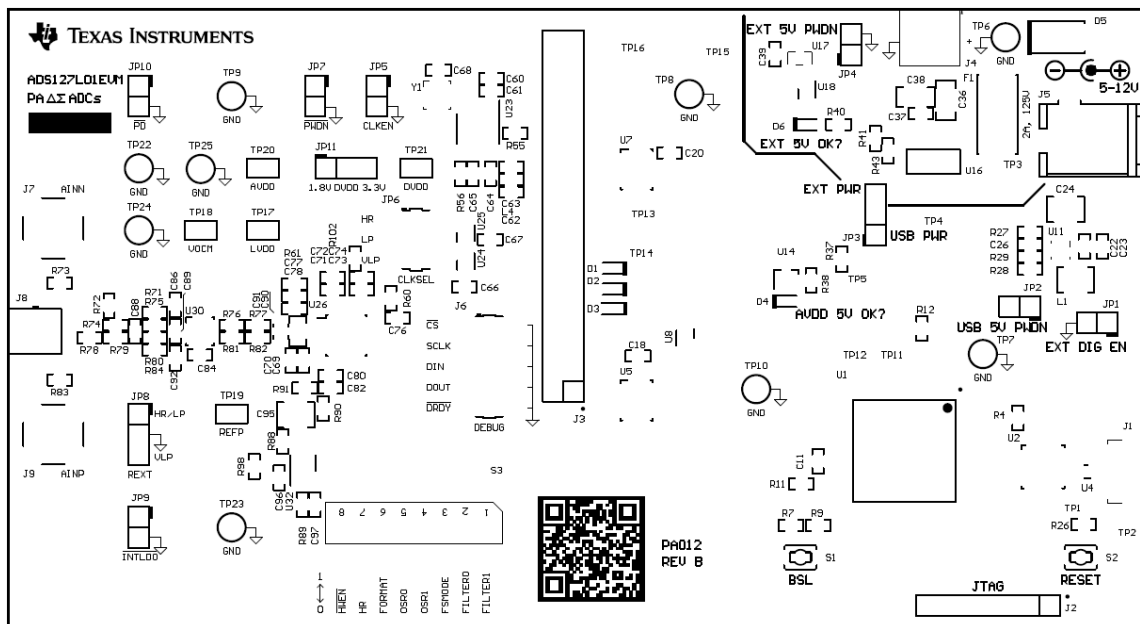


Figure 18. Top Silkscreen

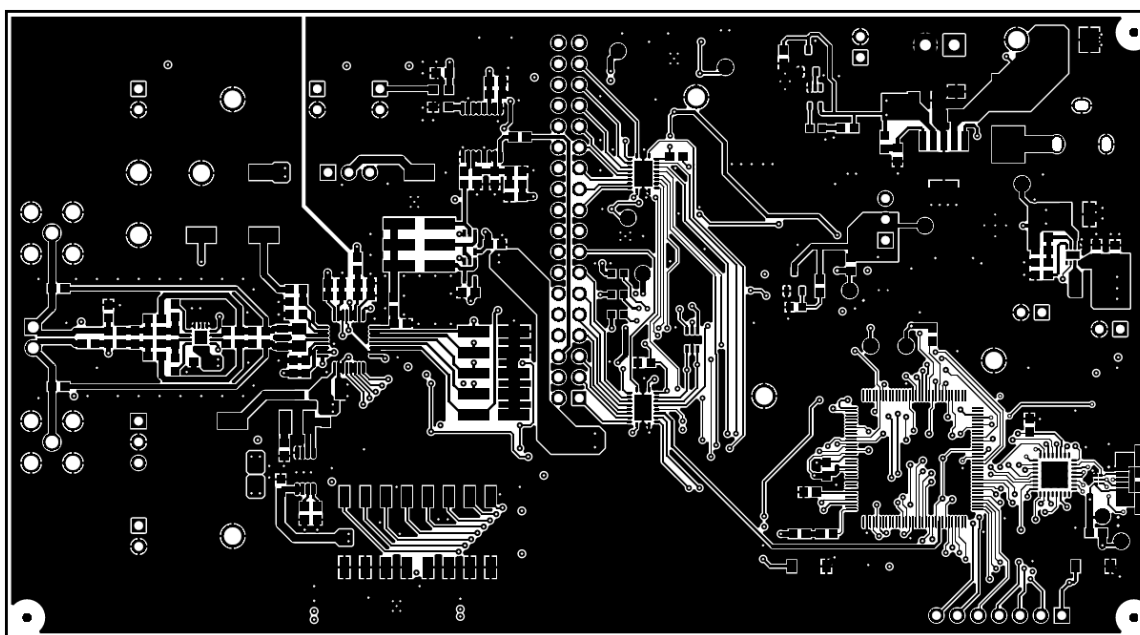


Figure 19. Top Layer (Positive)

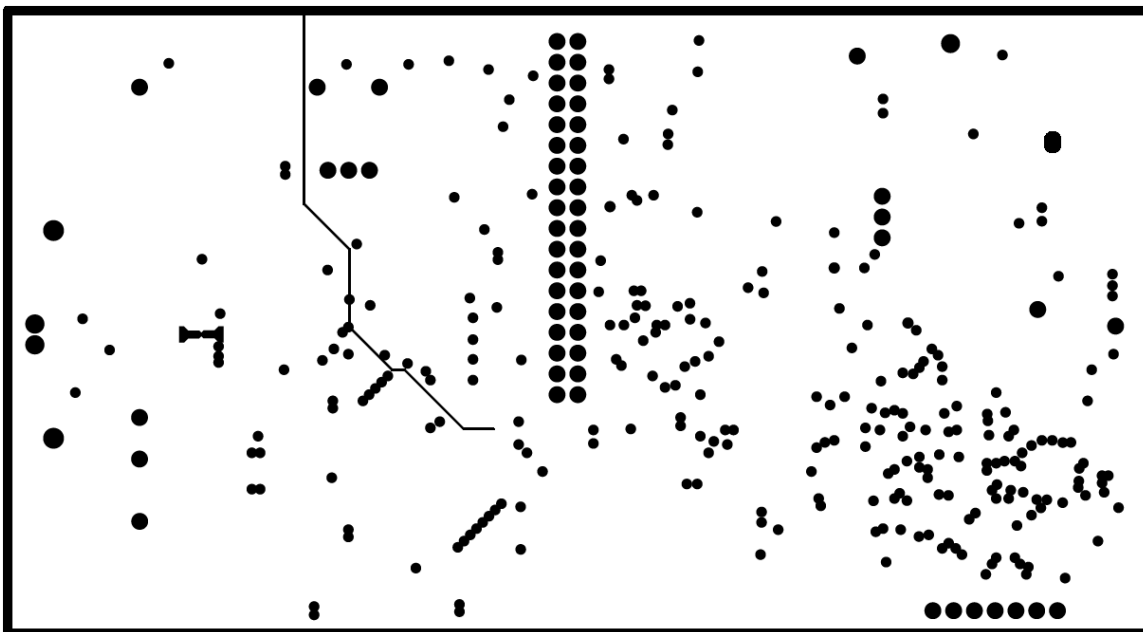


Figure 20. Ground (Negative)

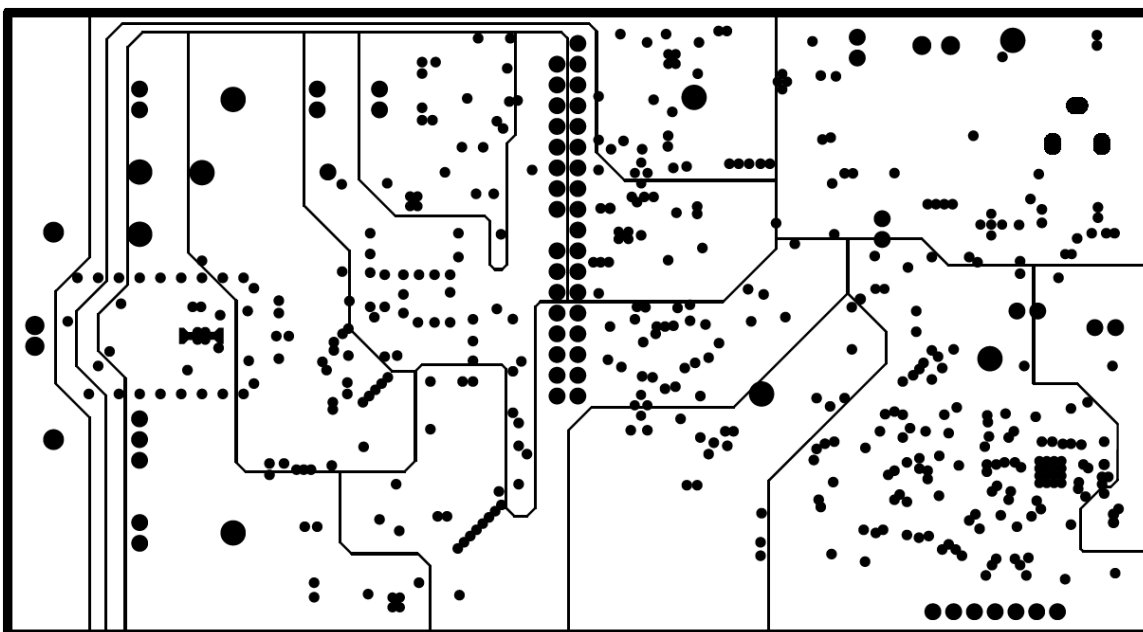


Figure 21. Power (Negative)

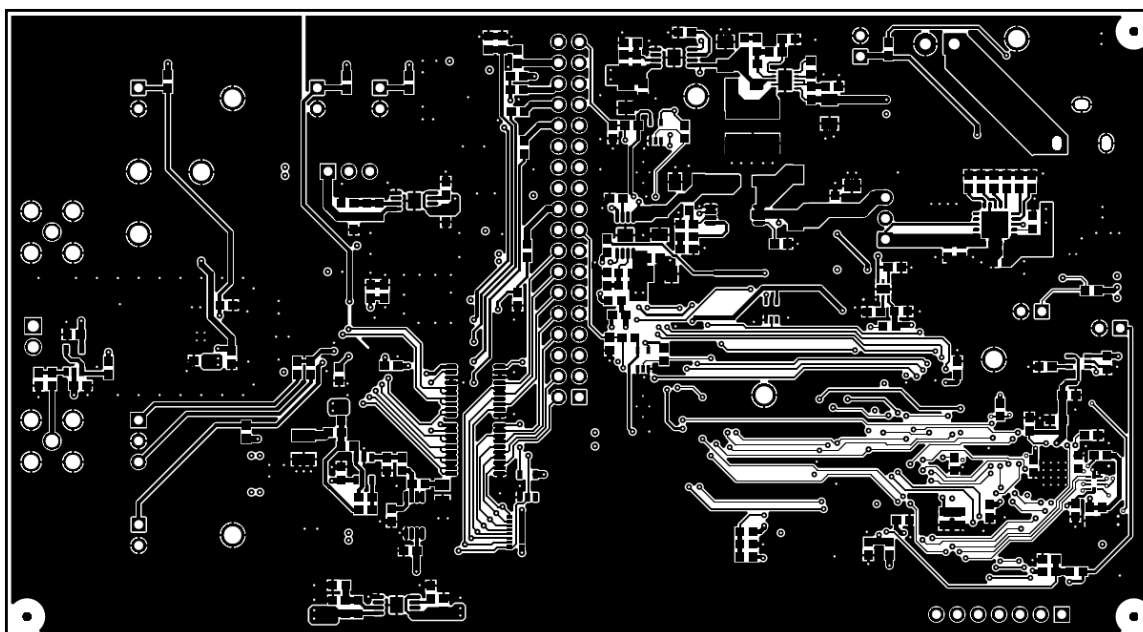


Figure 22. Bottom Layer (Positive)

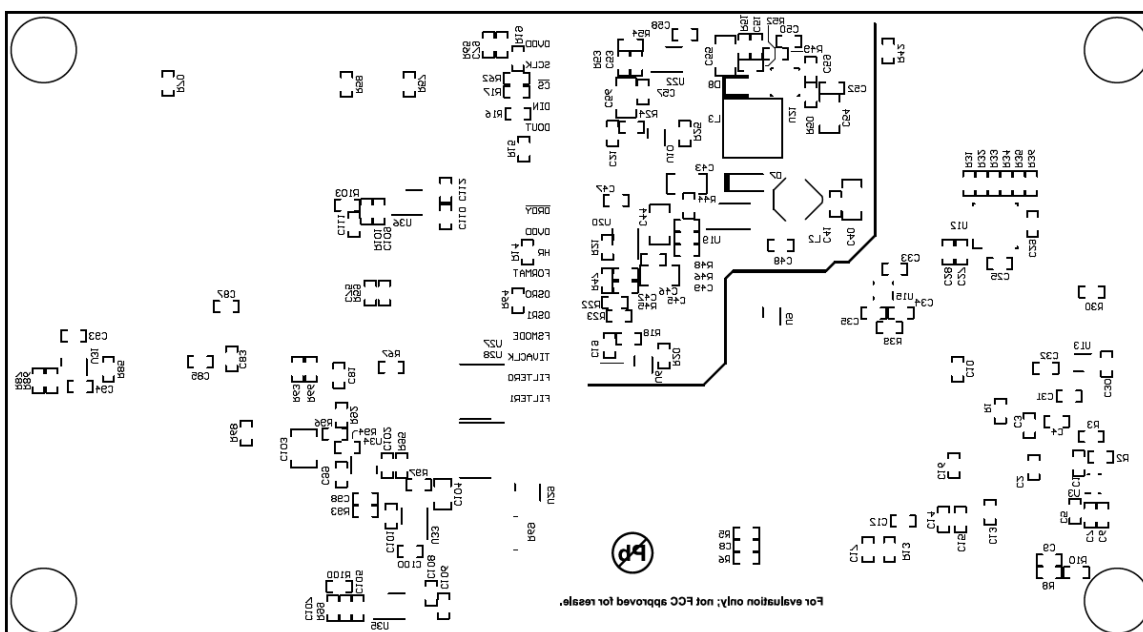
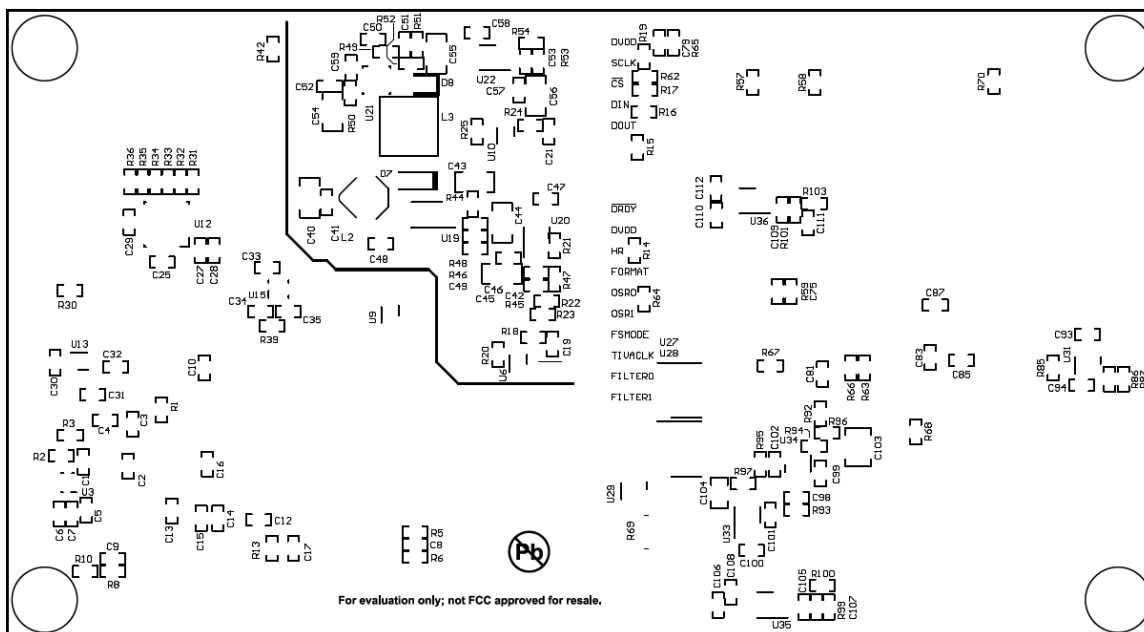


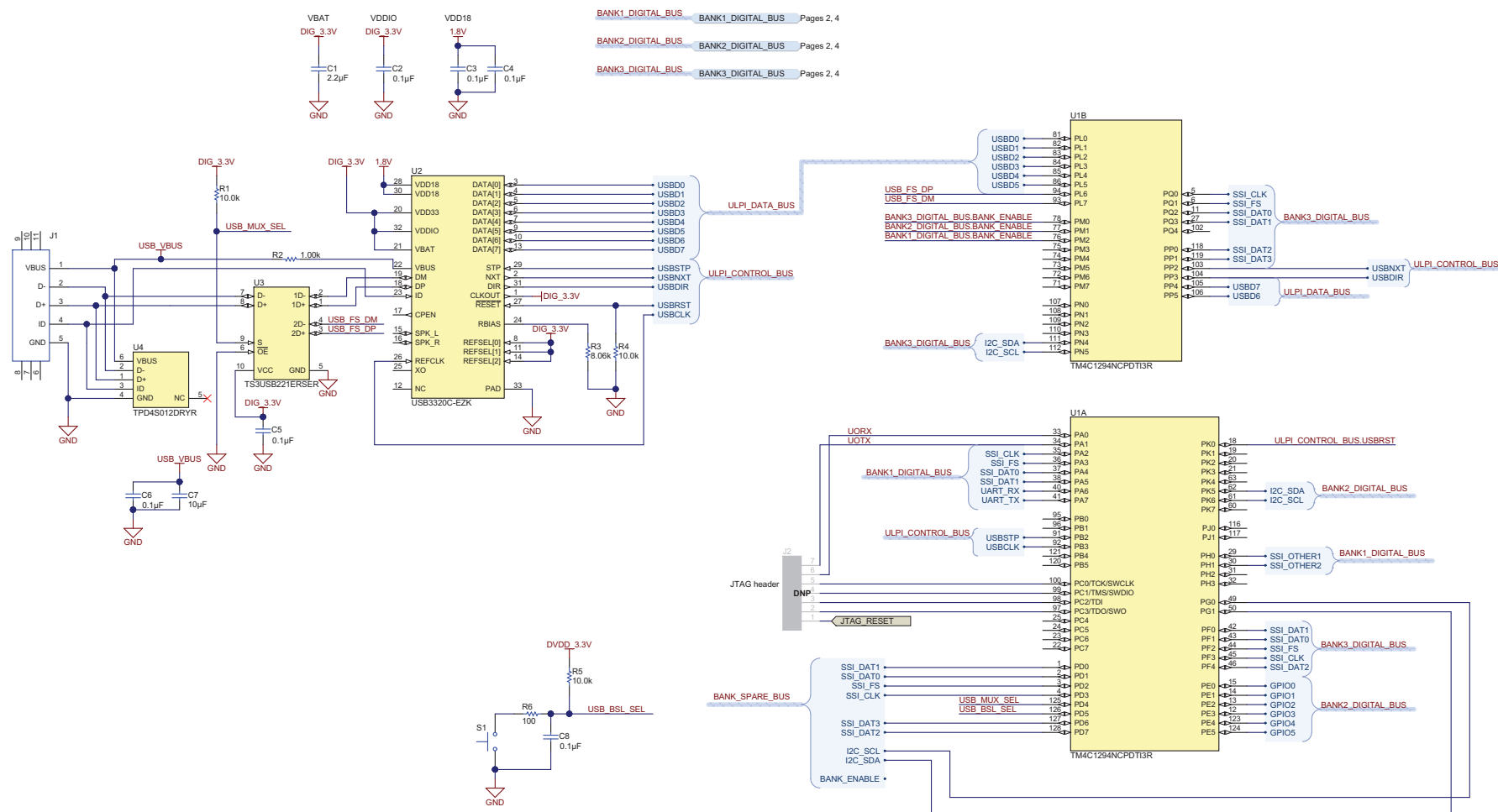
Figure 23. Bottom Silkscreen



**Figure 24. Bottom Silkscreen (Mirrored)**

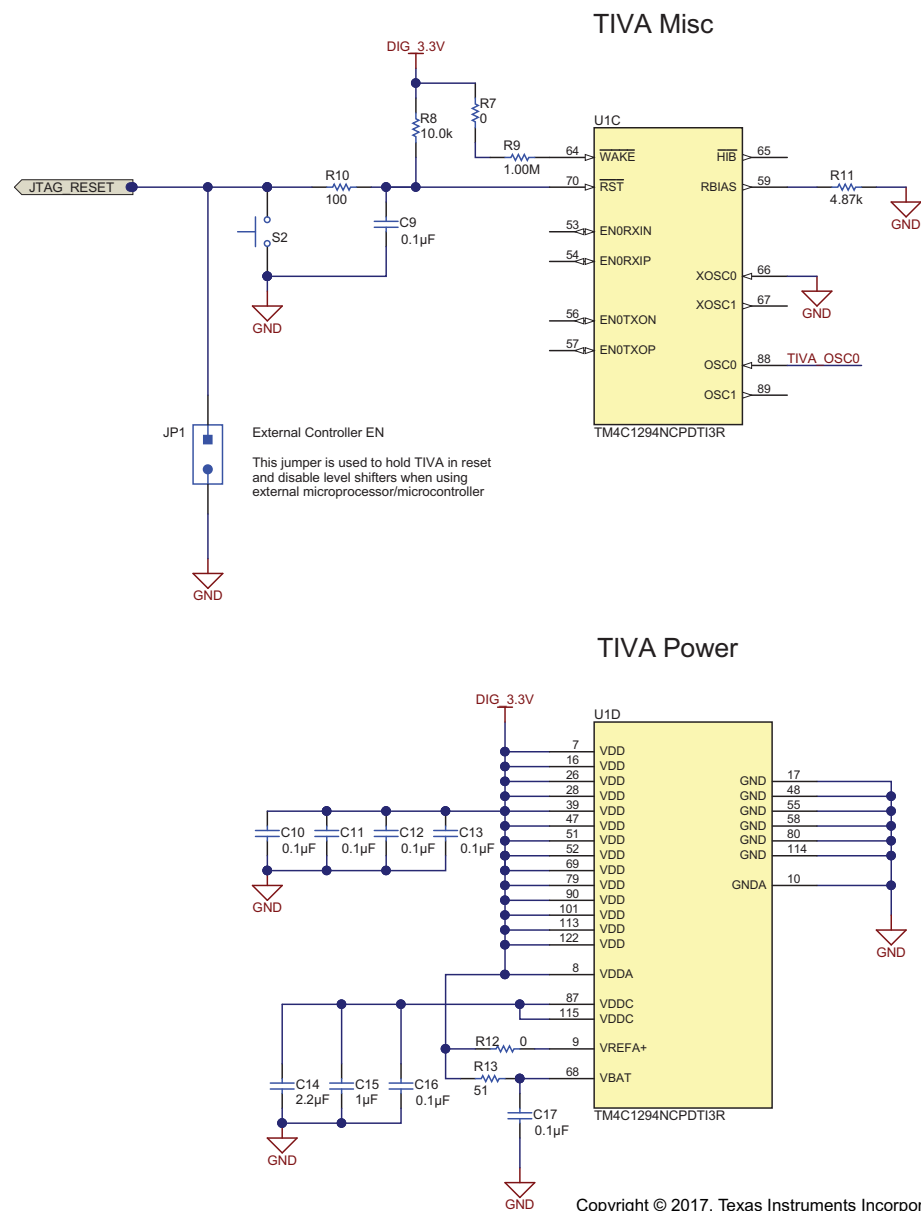
## 7.3 Schematic

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



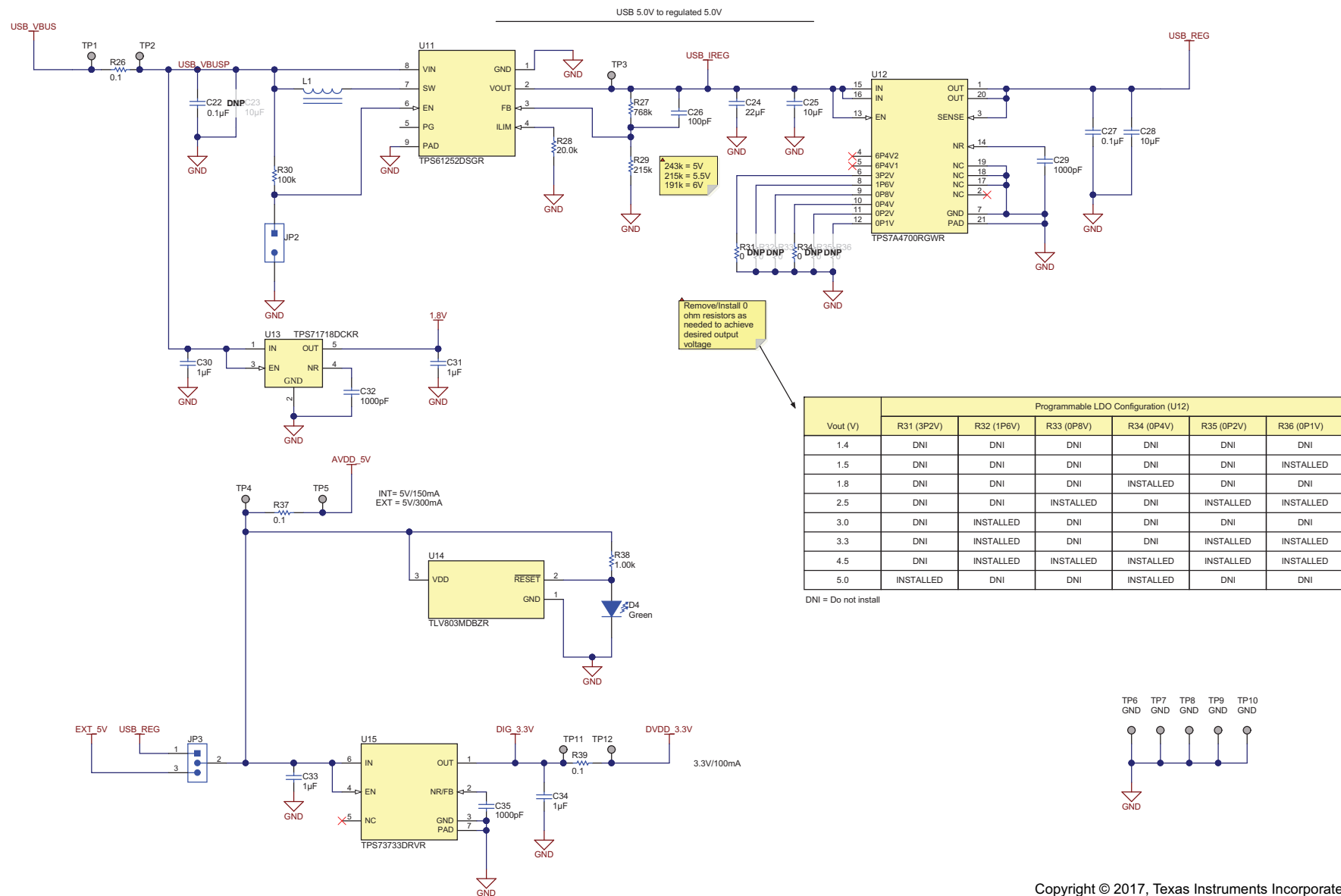


Figure 28. ADS127L01EVM USB Power Schematic

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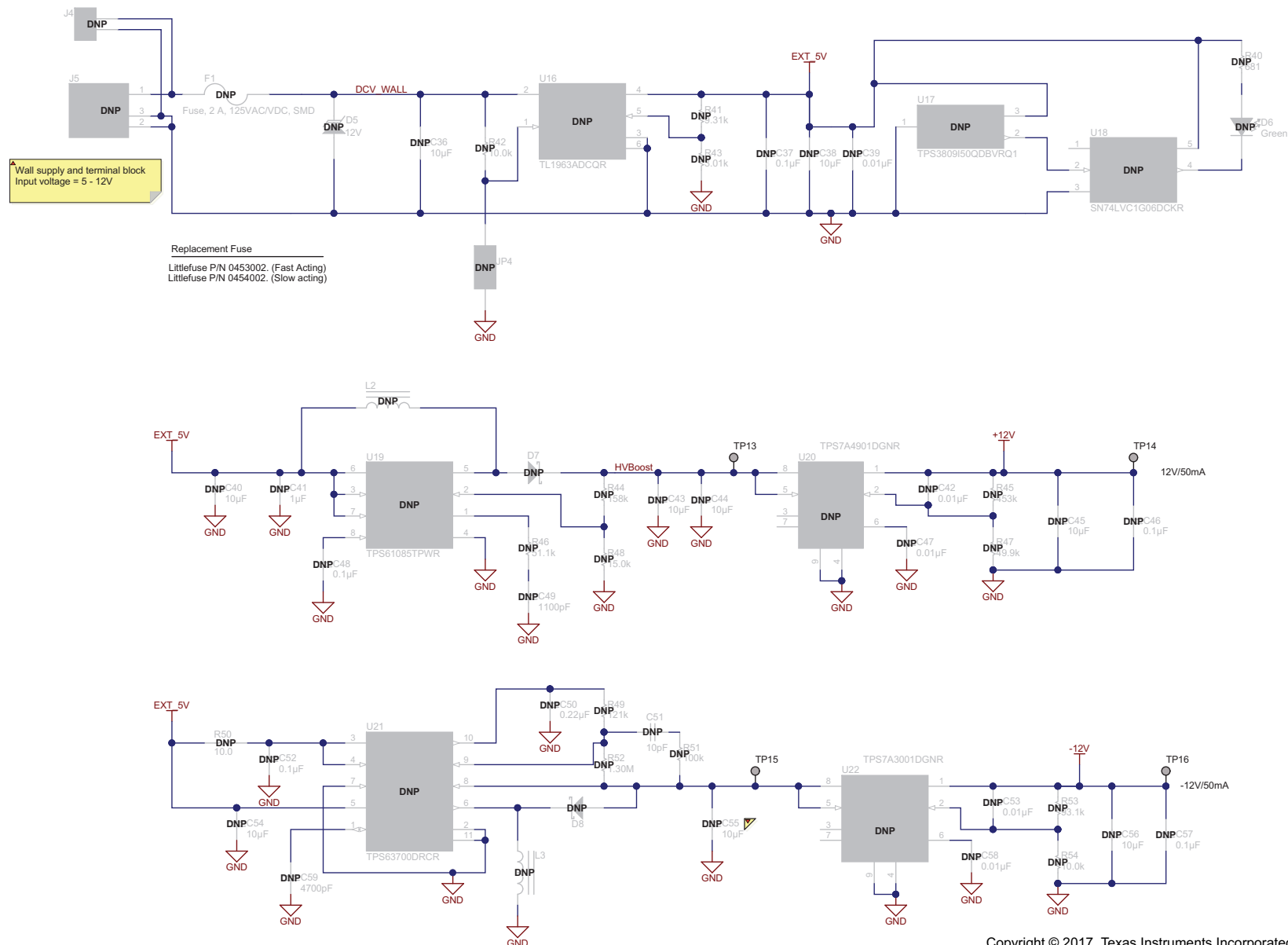


Figure 29. ADS127L01EVM External Power Schematic

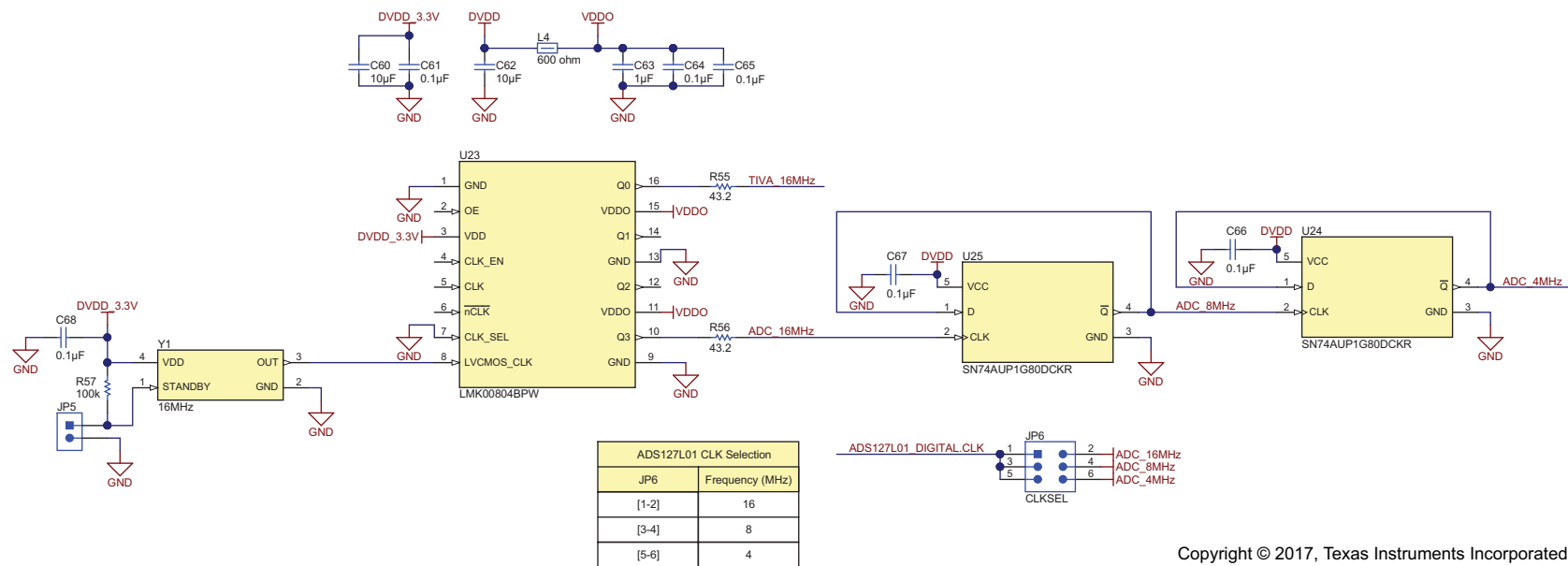
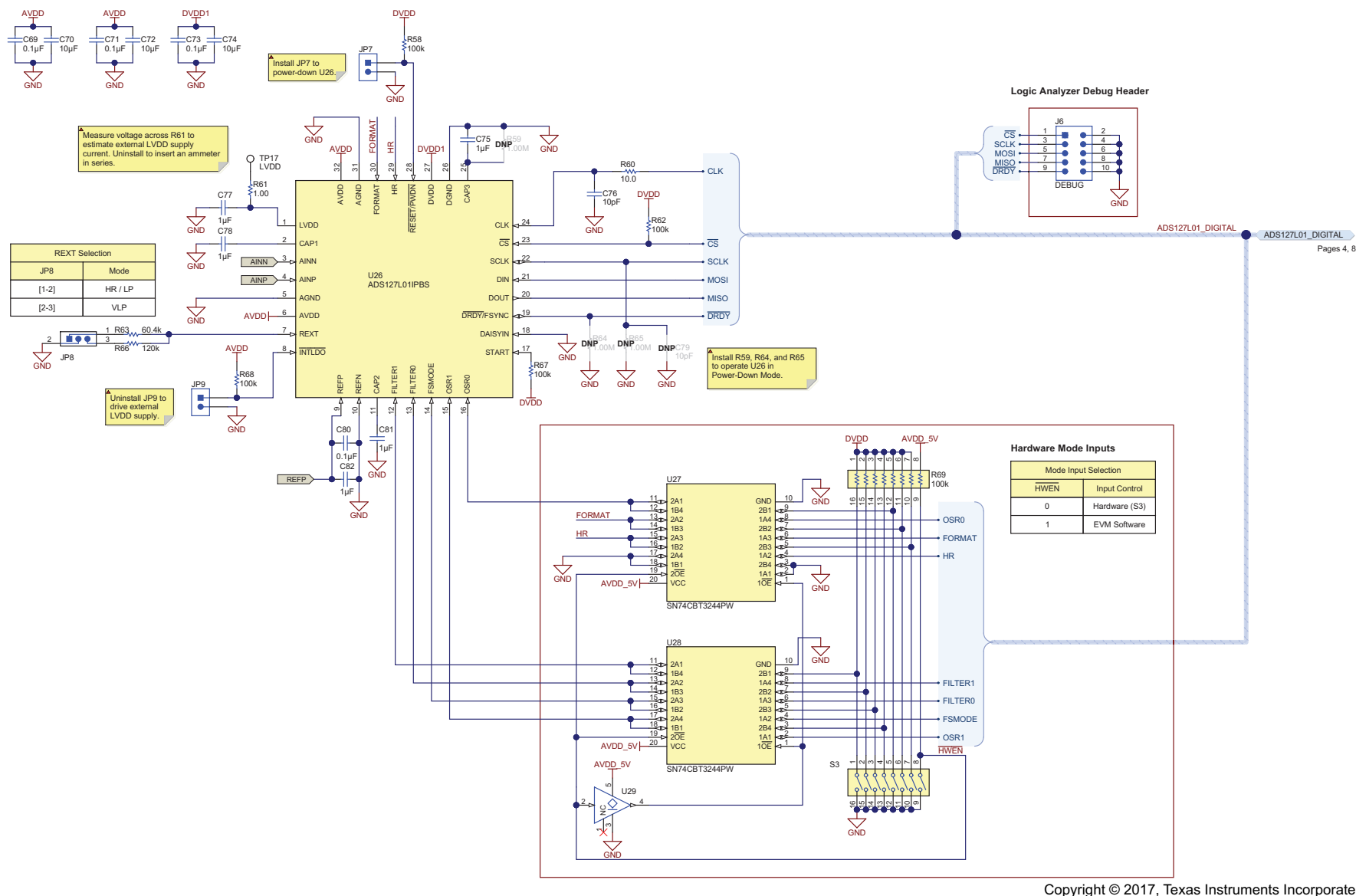


Figure 30. ADS127L01EVM Clock Tree Schematic

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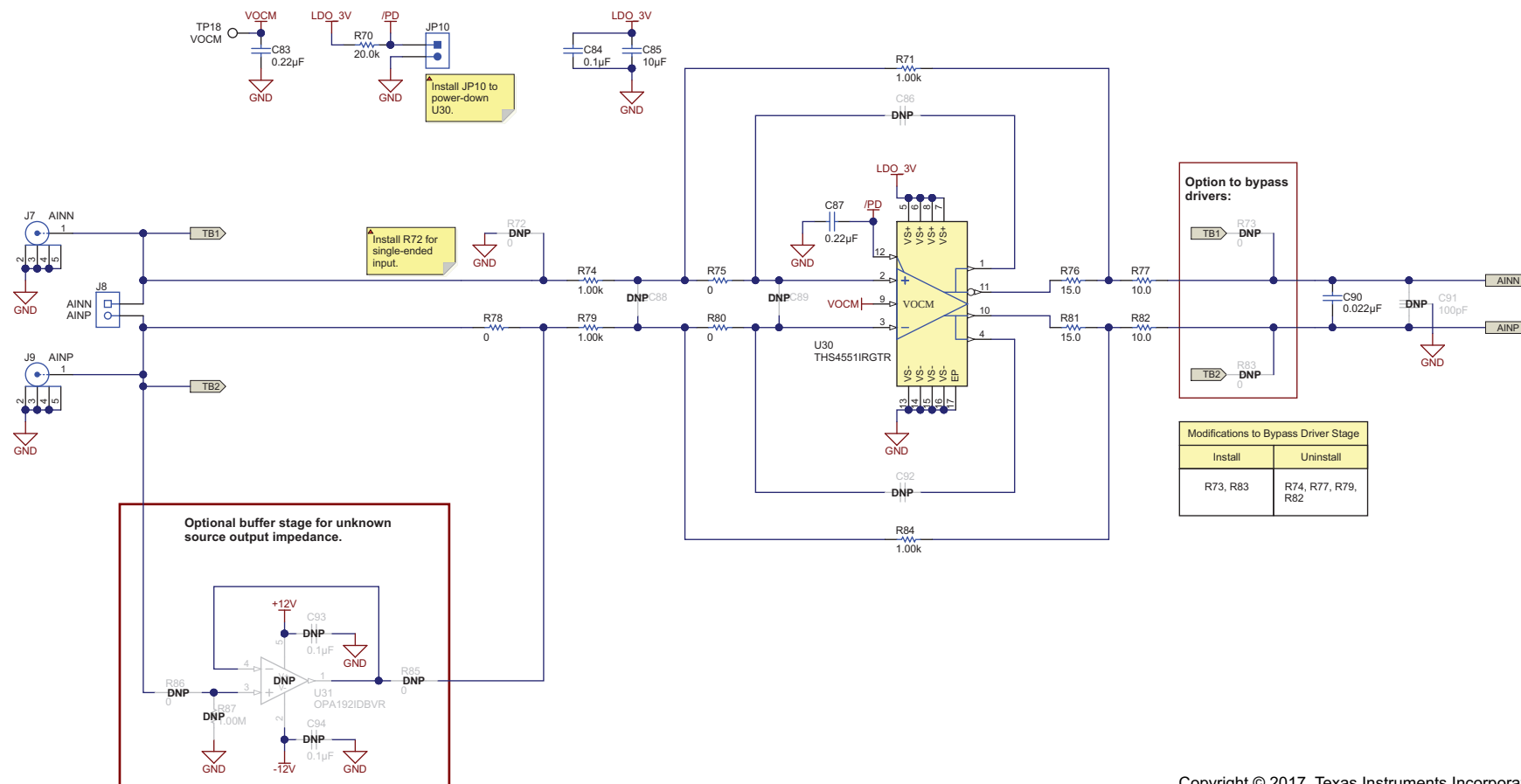


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Figure 31. ADS127L01EVM ADC Main Schematic

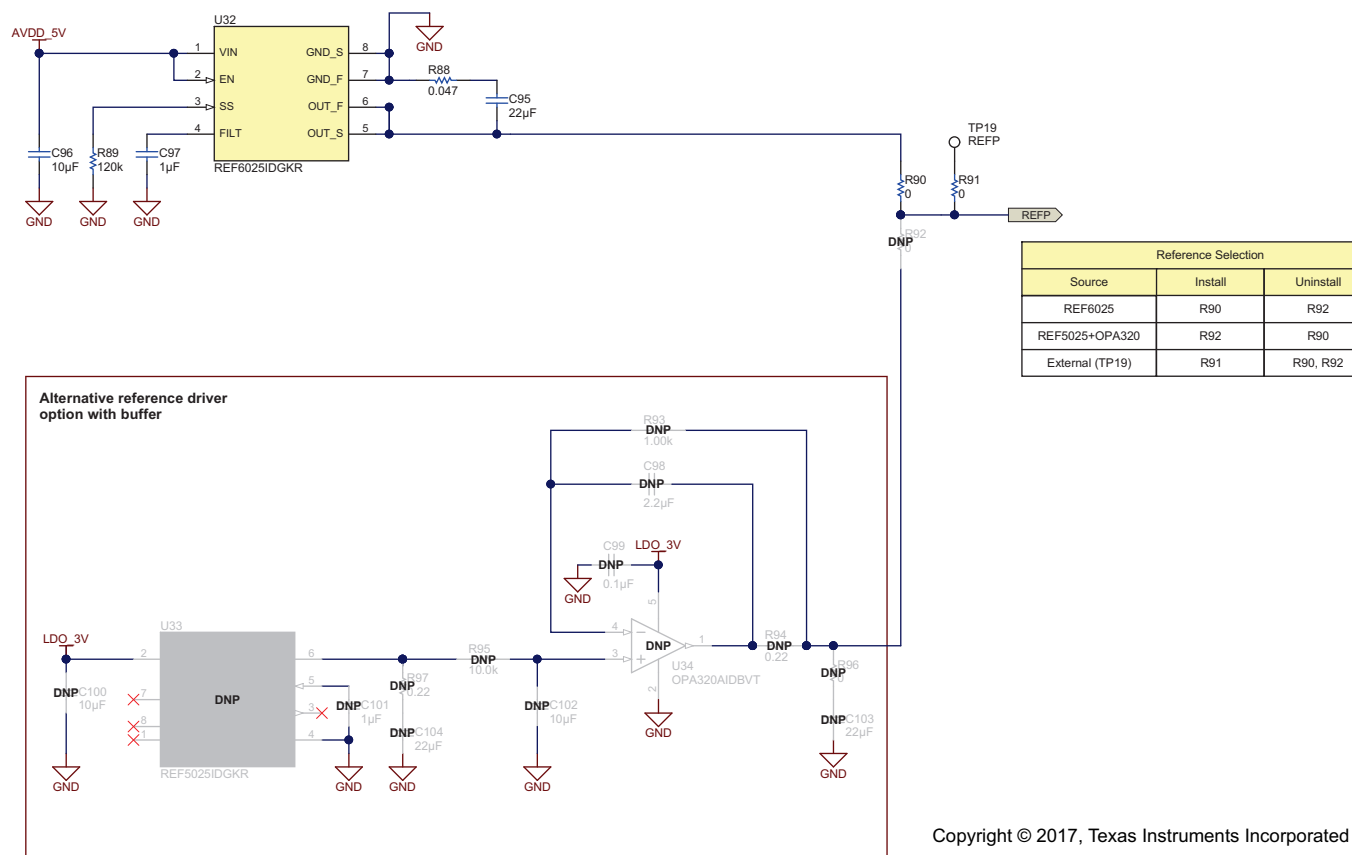
| Alternate Driver Options |                              |                        |                           |                                 |
|--------------------------|------------------------------|------------------------|---------------------------|---------------------------------|
| U30                      | 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.



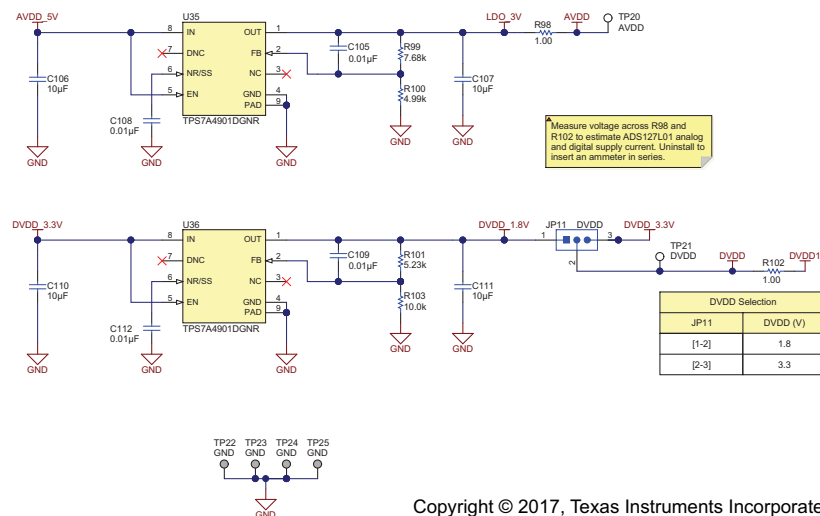
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**Figure 32. ADS127L01EVM ADC Input Driver Schematic**



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Figure 33. ADS127L01EVM ADC Reference Schematic



**Figure 34. ADS127L01EVM ADC Power Schematic**

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## 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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### **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.

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- *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.*

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(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.

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#### Concernant les EVMs avec antennes détachables

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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
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