ADS127L01EVM

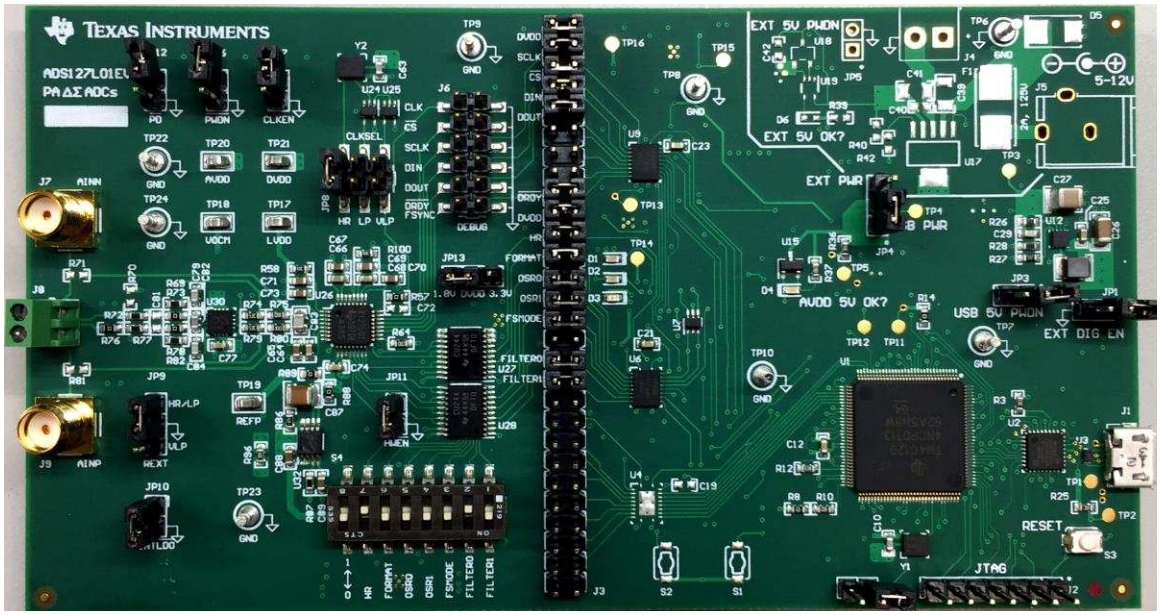


Figure 1. ADS127L01EVM

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

Table 1. Related Documentation

Device	Literature Number
ADS127L01	SBAS607

Contents

List of Figures

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 -> Options* 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, low-power, and very-low-power 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
- Onboard ADC clock options (CLK): 4 MHz, 8 MHz, 16 MHz

- Onboard or external ADC reference voltage (REFN always shorted to AGND)
- Power-down mode

1.4.2 Supported Software Functionality

- Software control over device mode pins:
  - High-resolution, low-power, and very-low-power 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 onboard processor
JP2	Uninstalled	Power-on Tiva external oscillator
JP3	Uninstalled	USB-derived supplies enabled
JP4	1-2	AVDD and DVDD derived from regulated USB supply
JP5	N/A	Not populated
JP6	Uninstalled	ADS127L01 powered-on
JP7	Uninstalled	Power-on ADS127L01 oscillator
JP8	1-2	CLK = 16 MHz
JP9	1-2	REXT = 60.4 kΩ
JP10	Installed	Internal LDO used for LVDD supply
JP11	Installed	HW control enabled for *Hardware Mode* inputs
JP12	Uninstalled	Input amplifier enabled
JP13	1-2	DVDD = 1.8 V
Switch	**Default Position**	**Comment**
S3	Open	Push to reset Tiva
S4	HR = 1 FORMAT = 0 OSR [1:0] = 00 FSMODE = 0(1) FILTER [1:0] = 01	High-Resolution Mode SPI Mode OSR = 32 Frame-Sync Slave Mode(1) Wideband 2 Filter (transition: 0.40 Fs to 0.50 Fs)

(1) Ignored when FORMAT = 0

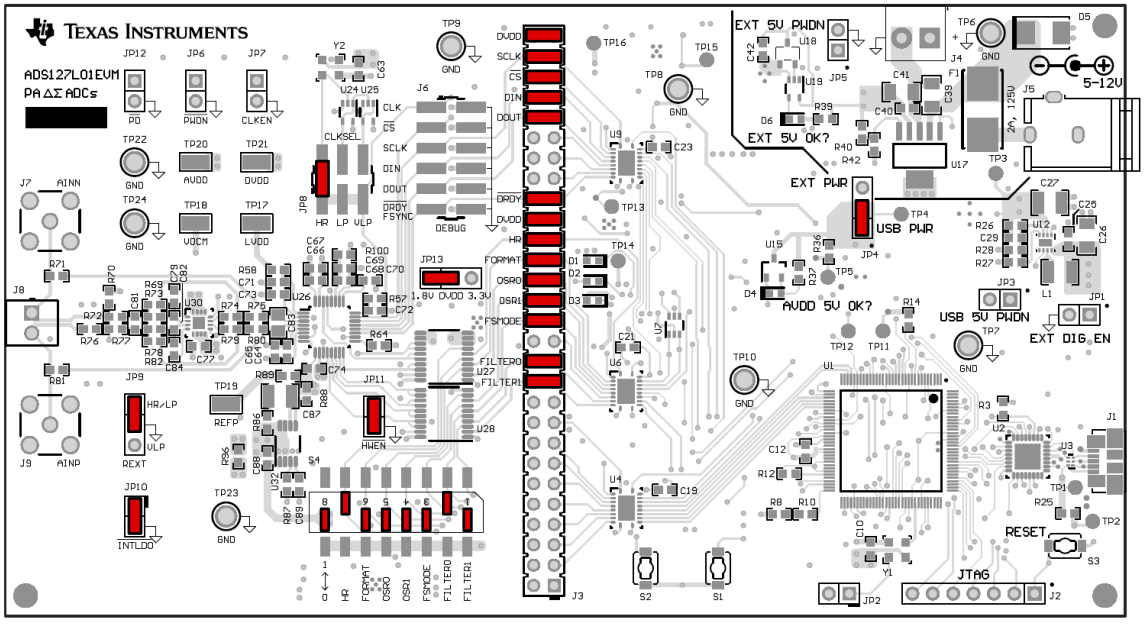


Figure 2. ADS127L01EVM Default Jumper and Switch Configuration

2.2 Power Connection

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

2.3 Startup

Use the following steps at startup:

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

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

3 Hardware Reference

3.1 Jumper and Switch Configuration Reference

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

Table 3. Hardware Item Descriptions

Jumper	Position	Description
JP1	Select onboard vs. external controller (U1 $\overline{\text{RST}}$)	
	Installed	Hold onboard Tiva in reset and disable level shifters to allow external digital interface
	Uninstalled	Normal operation with onboard Tiva
JP2	Power-down external Tiva oscillator (Y1 STANDBY)	
	Installed	Y1 output is disabled
	Uninstalled	Y1 output is enabled
JP3	Enable USB-derived power supplies (U12 EN)	
	Installed	USB-derived power supplies disabled
	Uninstalled	USB-derived power supplies enabled
JP4	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 (U13)
	2-3	Not used
JP5	Power-down external supplies (U17 EN)	
	Installed	External supplies disabled
	Uninstalled	External supplies enabled
JP6	Place ADS127L01 in *Power-Down Mode* (U26 $\overline{\text{RESET}}$/$\overline{\text{PWDN}}$)	
	Installed	ADS127L01 held in *Power-Down Mode*
	Uninstalled	Normal operation
JP7	Power-down external ADC oscillator ($\overline{\text{CLKEN}}$)	
	Installed	Y2 output is disabled
	Uninstalled	Y2 output is enabled
JP8	Select ADS127L01 CLK frequency (CLKSEL)	
	1-2	16 MHz
	3-4	8 MHz
	5-6	4 MHz

Table 3. Hardware Item Descriptions (continued)

Jumper	Position	Description
JP9	Select REXT pull-down resistor (REXT)	
	1-2	60.4 kΩ (HR and LP Mode)
	2-3	121 kΩ (VLP Mode)
JP10	Select source for LVDD supply (U26 $\overline{\text{INTLDO}}$)	
	Installed	Internal LDO enabled (LVDD sourced from AVDD)
	Uninstalled	Internal LDO disabled (LVDD sourced from external supply on TP17)
	NOTE: See the ADS127L01 datasheet (SBAS607) for LVDD voltage limits.	
JP11	Select Hardware or Software Control for ADS127L01 *Hardware Mode* pins ($\overline{\text{HWEN}}$)	
	Installed	HW inputs from S4
	Uninstalled	SW inputs through EVM GUI
JP12	Power-down input driver amplifier (U30 $\overline{\text{PD}}$)	
	Installed	Amplifier held in power-down
	Uninstalled	Normal operation
JP13	Select DVDD supply for ADS127L01 (DVDD)	
	1-2	DVDD = 1.8 V
	2-3	DVDD = 3.3 V
Switch	**Position**	**Description**
S3	Reset onboard controller (U1 $\overline{\text{RST}}$)	
	Closed	Tiva held in RESET
	Open	Normal operation
S4	*Hardware Mode* inputs (used when JP11 is installed)	
	Up	Logic ‘1’
	Down	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

The J2 header is provided for programming the onboard 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 *RESET* 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 onboard 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 V ≤ LVDD ≤ 1.9 V
Input Common-Mode Voltage	VOCM	TP18	0.88 V ≤ VOCM ≤ 1.9 V
ADC Reference Voltage	REFP	TP19	0.5 V ≤ VREF ≤ 3.0 V
ADC Analog Supply	AVDD	TP20	2.7 V ≤ AVDD ≤ 3.6 V
ADC Digital Supply	DVDD	TP21	1.7 V ≤ DVDD ≤ 3.6 V
System Ground	GND	TP22, TP23, TP24	AGND = DGND

3.2.4 Digital Interface Header

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

Table 7. Digital Interface Header, J3

Function	Processor Side		ADC Side	
	Signal Name	Pin Number[1]	Pin Number[2]	Signal Name
GPIO Inputs for ADC *Hardware Mode* Pins	I2C0_SDA	21	22	FILTER1
	I2C0_SCL	23	24	FILTER0
	GPIO_4	27	28	FSMODE
	GPIO_3	29	30	OSR1
	GPIO_2	31	32	OSR0
	GPIO_1	33	34	FORMAT
	GPIO_0	35	36	HR
IOVDD Supply for Level Translator (U6)	DIG_VOLT2	37	38	DVDD
GPIO	I2C1_SDA	39	40	$\overline{\text{DRDY}}$
SPI Port	SPI1_MISO/DATA1	47	48	MISO
	SPI1_MOSI/DATA0	49	50	MOSI
	SPI1_FS	51	52	$\overline{\text{CS}}$
	SPI1_SCLK	53	54	SCLK
IOVDD Supply for Level Translator (U9)	DIG_VOLT3	55	56	DVDD

(1) Odd numbered pins not included are connected to Tiva inputs whose functionality is not used for this EVM. See Figure 20 for connection details.

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

3.2.5 Debug Header

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

Table 8. Debug Header, J6

Function	Signal Name	Pin Number[1]
Digital Signals for Logic Analyzer or External Processor	CLK	1
	$\overline{CS}$	3
	SCLK	5
	DIN	7
	DOUT	9
	$\overline{DRDY}$	11

(1) Pins 2 – 12 (even) are tied to DGND.

4 ADS127L01EVM Software

4.1 Installing the Software

4.1.1 Delta-Sigma ADC EvaluaTIon Software

Download the *DELTASIGMAEVAL-GUI-installer.exe* 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.

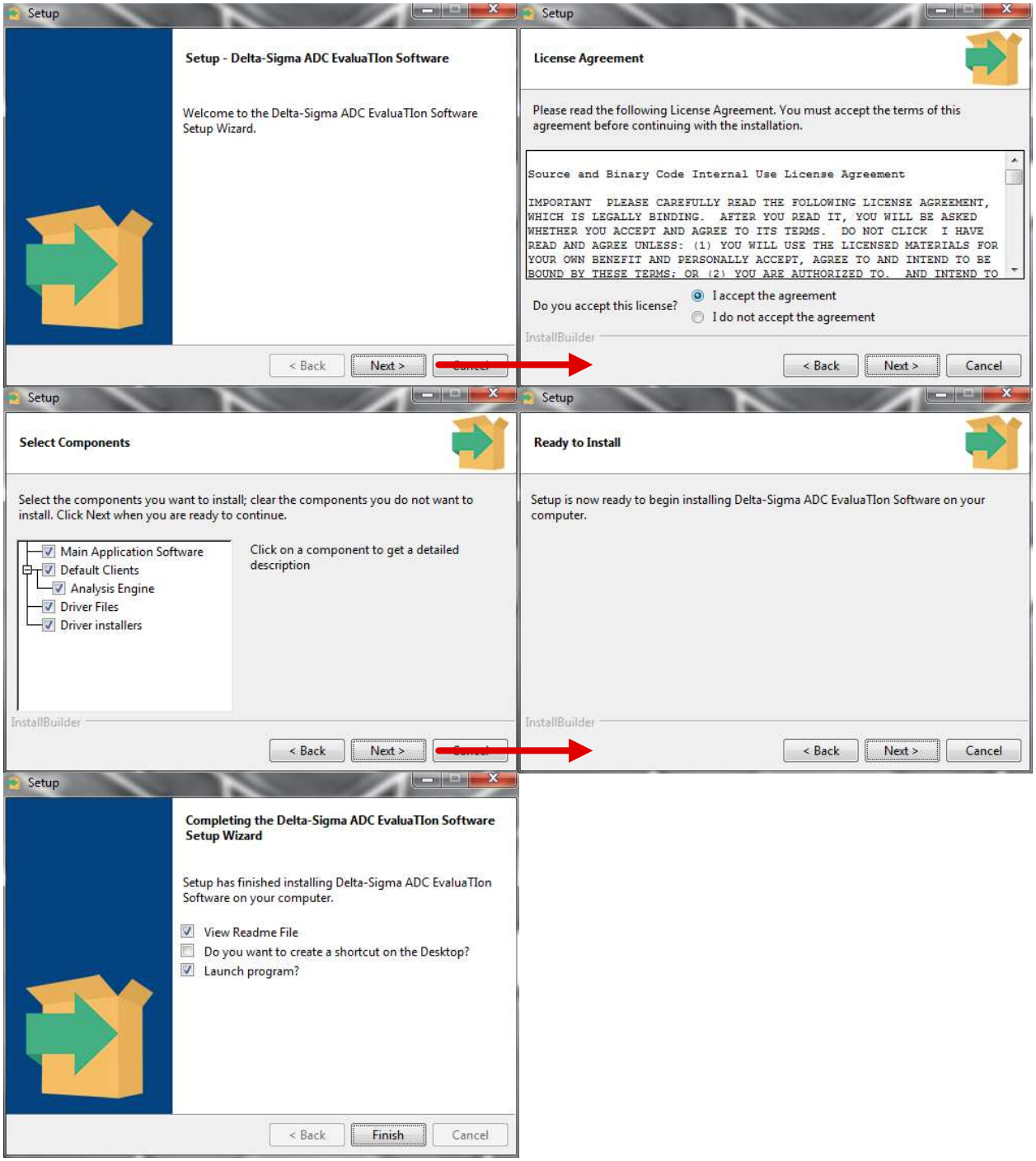


Figure 3. Delta-Sigma ADC EvaluaTIon Software Installation Instructions

4.1.2 ADS127L01 Device Package

Download the *ADS127L01-0.3.2.5-devpkg.exe* installer from the ADS127L01EVM tool page and save to a known folder. Run the *ADS127L01-0.3.2.5-devpkg.exe* installer and follow the on-screen prompts. Note that future software versions may show slightly different screens.

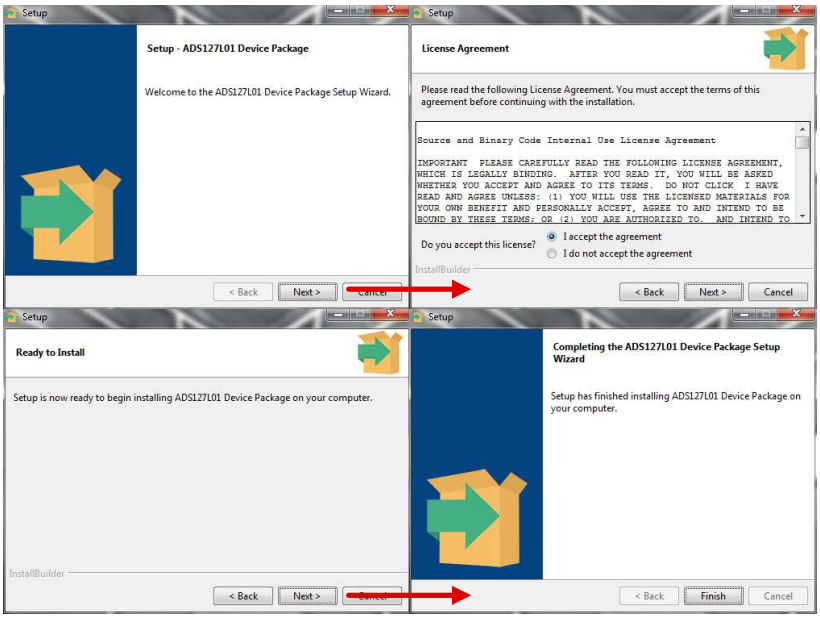


Figure 4. ADS127L01 Device Package Installation Instructions

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.

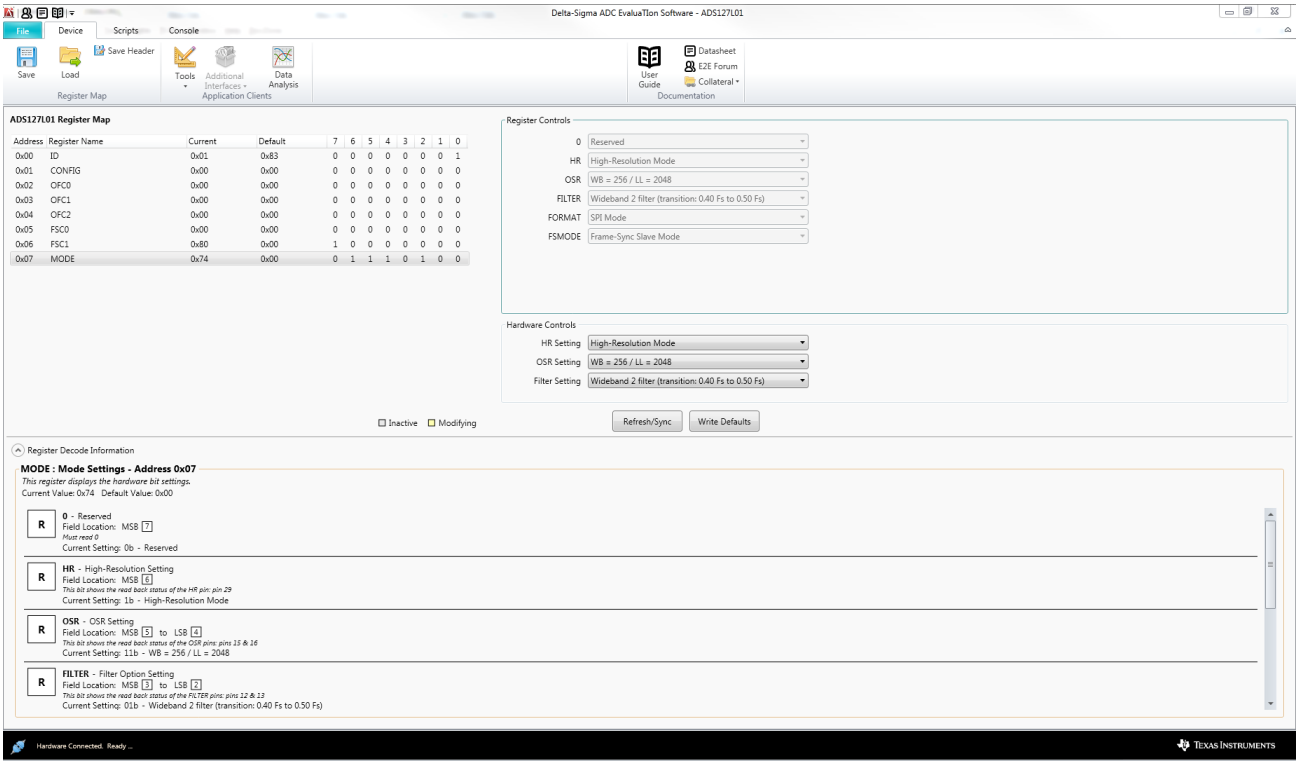


Figure 5. ADS127L01 Register Map and Main Tab

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 with 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), including the 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.

4.3.1 Hardware Controls

The EVM software provides an alternate way to configure the ADS127L01 hardware mode pins when JP11 is uninstalled. 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 6.

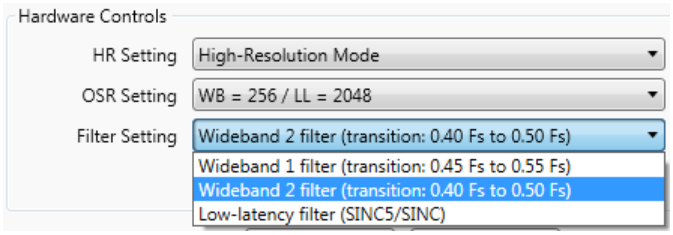


Figure 6. Software Controls for Hardware Mode Inputs

4.3.2 Data Collection

Data is collected by clicking the *Data Analysis* button from the ribbon menu. This will launch the *Analysis Engine* in a separate window. The *Analysis Engine* is used to collect, analyze, and save data from the EVM. For more information about the *Analysis Engine*, please see the *Delta-Sigma ADC EvaluaTIon Software User Manual* (SBAU260).

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 AGND by installing R70. Use either J9 or J8[2] to connect the analog input signal.

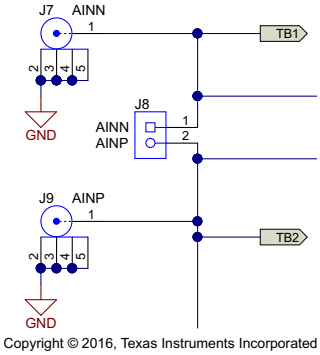


Figure 7. Analog Input Connections (Schematic)

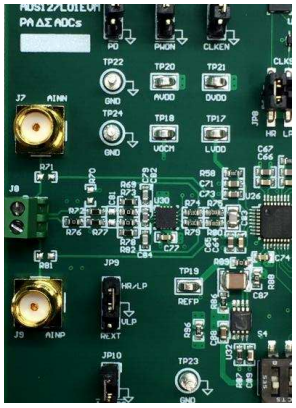
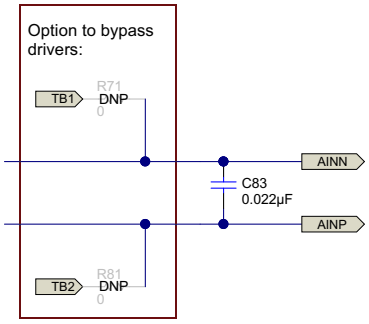


Figure 8. Analog Input Connections (PCB)

The onboard input driver may be bypassed to evaluate other driver solutions or to test the ADC performance directly. To bypass U30, uninstall R72, R75, R77, and R80. Install R71 and R81 with 0-Ω resistors. J7 and J8[1] will connect directly to AINN, and J9 and J8[2] will connect directly to AINP. Ensure that the analog inputs are within the input voltage limits of the ADS127L01.



Modifications to Bypass Driver Stage	
Install	Uninstall
R71, R81	R72, R75, R77, R80

Figure 9. 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 onboard at ±12 V. To generate the bipolar supplies, install all components on the *External Power* schematic page, connect an external 5 V–12 V DC wall supply to J4 or J5, and uninstall JP5.

5.2 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 DGND (pins 2 – 12, even). See Table 8

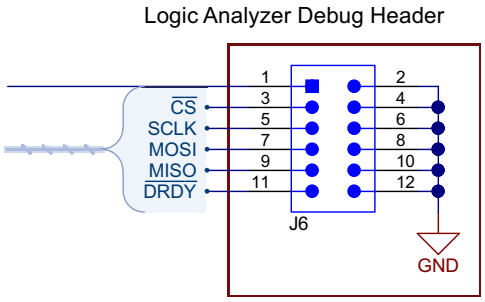


Figure 10. Debug Header for Logic Analyzer (Schematic)

Figure 11. Debug Header for Logic Analyzer (PCB)

5.3 Clock Inputs

The onboard oscillator, Y2, provides a 16-MHz, low-jitter clock for the ADS127L01. Two D flip-flops (U24 and U25) are cascaded to divide the Y2 output into 8- and 4-MHz frequencies as shown in Figure 12. All onboard clock frequencies are available on JP8 (see Table 3).

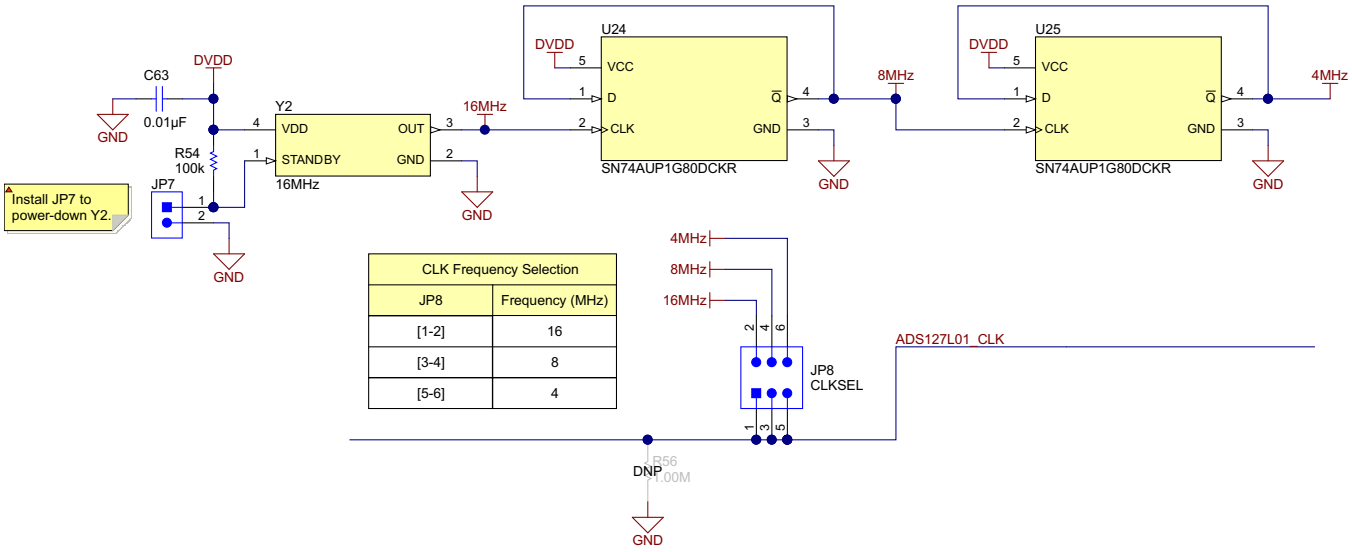


Figure 12. Clock Input Options

NOTE: The two clock sources used on the ADS127L01EVM Rev A (Y1 and Y2) are not synchronous. This will introduce small tones in the frequency spectrum from clock intermodulation that are not harmonics of the fundamental input signal and not caused by the ADS127L01. The result is a slight degradation in performance. This issue will be addressed promptly in Rev B of the EVM.

5.4 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.

JP11 must be installed to configure the hardware mode pins with the EVM hardware. Each hardware mode pin is tied to DVDD through a switch on S4 and a 100-kΩ, pull-up resistor (R66). Placing the switches on S4 in the UP position will pull up the respective mode pins to DVDD. Placing the switches in the DOWN position will pull down the respective mode pins to DGND. FORMAT must always be low to use the EVM with the provided software.

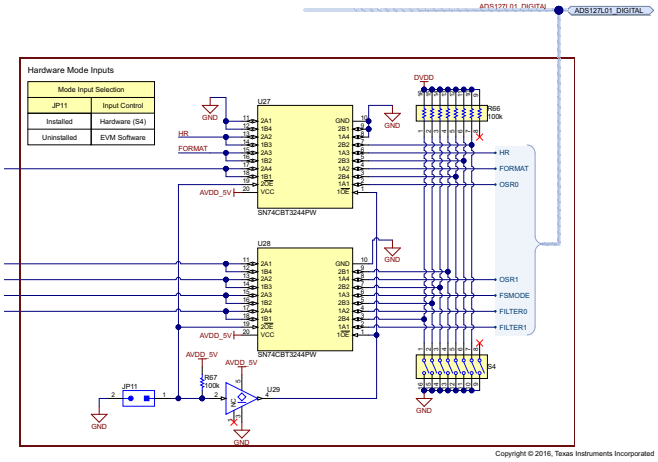


Figure 13. Hardware Mode Input Controls (Schematic)

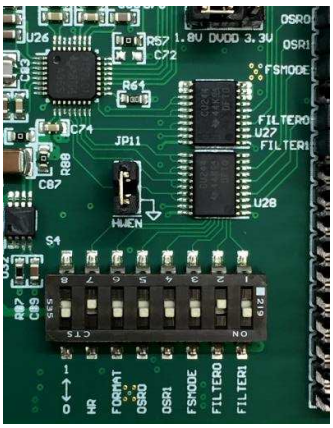


Figure 14. Hardware Mode Input Controls (PCB)

Uninstalling J11 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.

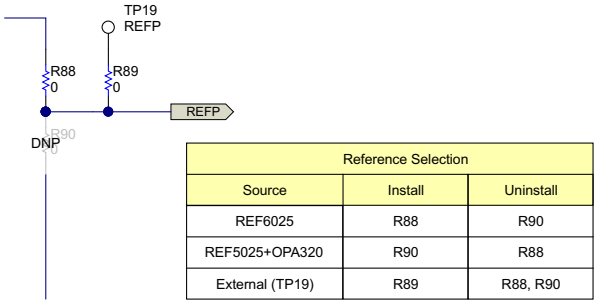
5.5 ADC Reference

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

The default reference driver on the EVM is the REF6025. The output of the REF6025 is connected to REFP through R88.

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. Before populating this alternate reference driver circuit, be sure to uninstall R88 and install R89 with a 0-Ω resistor.

When using the onboard reference driver, 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 R88 and R90 must be uninstalled. Performance may not be optimal when connecting a reference voltage in this manner.



Reference Selection		
Source	Install	Uninstall
REF6025	R88	R90
REF5025+OPA320	R90	R88
External (TP19)	R89	R88, R90

Figure 15. Reference Input Selection

5.6 Power-Down Mode

The ADS127L01 can be placed in Power-Down Mode by installing JP6. When evaluating the device in Power-Down Mode, R61, R62, and R102 must be populated with 1-MΩ resistors.

6 Power Supply Connections

6.1 Powering the EVM

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

6.1.1 USB Powered

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 JP4 to [1-2].

6.1.2 External Powered

To power the EVM from an external supply, uninstall the jumper from JP4 and connect 5 V to JP4[2]. Be sure to also connect the external supply ground to one of the GND test points on the EVM.

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. AGND and DGND are shorted to the system ground (GND).

6.2.1 Analog Supplies

A 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 R97 (0.1 Ω). Measure the voltage across R97 or insert an ammeter in series to measure the AVDD supply current.

When JP10 is installed, the LVDD supply is sourced from AVDD using an internal LDO in the ADS127L01. To drive an external LVDD supply, uninstall JP10 and connect the external supply voltage to TP17. Be sure to share the external supply ground with AGND using one of the ground 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 JP13 to either [1-2] = 1.8 V or [2-3] = 3.3 V. Measure the voltage across R100 (0.1 Ω) or insert an ammeter in series to measure the DVDD supply current.

7 ADS127L01 Bill of Materials and Schematics

7.1 Bill of Materials

Table 9 lists the EVM bill of materials.

Table 9. ADS127L01 Bill of Materials(1)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		PA012	Any		
C1, C15	2	2.2uF	CAP, CERM, 2.2 µF, 35 V, +/- 10%, X5R, 0603	0603	GRM188R6YA225KA12D	Murata		
C2, C3, C4, C5, C9, C11, C12, C13, C14, C17, C18, C21, C22, C23, C24, C25, C30, C64, C66, C68, C74, C77	22	0.1uF	CAP, CERM, 0.1 µF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX		
C6, C88, C98, C99, C102, C103	6	10uF	CAP, CERM, 10 µF, 25 V, +/- 20%, X5R, 0603	0603	GRM188R61E106MA73	Murata		
C10, C63, C97, C100, C101, C104	6	0.01uF	CAP, CERM, 0.01 µF, 25 V, +/- 5%, C0G/NP0, 0603	0603	C1608C0G1E103J	TDK		
C16, C33, C34, C36, C37, C65, C67, C69, C70, C71, C73, C75, C78, C89	14	1uF	CAP, CERM, 1 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E105KA12D	Murata		
C26, C28, C31	3	10uF	CAP, CERM, 10 µF, 35 V, +/- 10%, X7R, 1206	1206	GMK316AB7106KL	Taiyo Yuden		
C27	1	22uF	CAP, CERM, 22 µF, 16 V, +/- 20%, X7R, 1210	1210	C3225X7R1C226M	TDK		
C29	1	100pF	CAP, CERM, 100 pF, 25 V, +/- 10%, X7R, 0603	0603	06033C101KAT2A	AVX		
C32, C35, C38	3	1000pF	CAP, CERM, 1000 pF, 100 V, +/- 5%, X7R, 0603	0603	06031C102JAT2A	AVX		
C76, C80	2	0.22uF	CAP, CERM, 0.22 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E224KA88D	Murata		
C79, C84	2	47pF	CAP, CERM, 47 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	GRM1885C1H470FA01J	Murata		
C82	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	GRM1885C1H102FA01J	Murata		
C83	1	0.022uF	CAP, CERM, 0.022 µF, 50 V, +/- 5%, C0G/NP0, 0805	0805	GRM21B5C1H223JA01L	Murata		
C87	1	47uF	CAP, CERM, 47 µF, 10 V, +/- 10%, X7R, 1210	1210	GRM32ER71A476KE15L	Murata		
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		
J2	1		Header, 100mil, 7x1, Gold, TH	7x1 Header	TSW-107-07-G-S	Samtec		
J3	1		Header, 2.54 mm, 28x2, Gold, TH	Header, 2.54 mm, 28x2, TH	TSW-128-07-S-D	Samtec		
J6	1		Header, 2.54mm, 6x2, Gold, SMT	Header, 2.54mm, 6x2, SMT	TSM-106-01-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, JP3, JP6, JP7, JP10, JP11, JP12	8		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
JP4, JP9, JP13	3		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		

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

Table 9. ADS127L01 Bill of Materials[(1)] (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
JP8	1		Header, 2.54mm, 3x2, Gold, SMT	Header, 2.54mm, 3x2, SMT	TSM-103-01-L-DV	Samtec		
L1	1	1uH	Inductor, Wirewound, Ferrite, 1 µH, 2.05 A, 0.045 ohm, SMD	1210	LQH32PN1R0NN0	Murata		
R1, R37	2	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	CRCW06031K00FKEA	Vishay-Dale		
R2	1	8.06k	RES, 8.06 k, 1%, 0.1 W, 0603	0603	CRCW06038K06FKEA	Vishay-Dale		
R3, R9, R20, R23, R101	5	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale		
R8, R14, R30, R33, R57, R73, R76, R78, R88, R89	10	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale		
R10	1	1.00Meg	RES, 1.00 M, 1%, 0.1 W, 0603	0603	CRCW06031M00FKEA	Vishay-Dale		
R11	1	100	RES, 100, 1%, 0.1 W, 0603	0603	CRCW0603100RFKEA	Vishay-Dale		
R12	1	4.87k	RES, 4.87 k, 1%, 0.1 W, 0603	0603	CRCW06034K87FKEA	Vishay-Dale		
R13, R21, R24, R29, R54, R55, R59, R64, R65, R67	10	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale		
R15	1	51	RES, 51, 5%, 0.1 W, 0603	0603	CRCW060351R0JNEA	Vishay-Dale		
R18, R19, R22	3	681	RES, 681, 1%, 0.1 W, 0603	0603	CRCW0603681RFKEA	Vishay-Dale		
R25, R36, R38, R58, R96, R100	6	0.1	RES, 0.1, 1%, 0.1 W, 0603	0603	ERJ-L03KF10CV	Panasonic		
R26	1	768k	RES, 768 k, 1%, 0.1 W, 0603	0603	RC0603FR-07768KL	Yageo America		
R27	1	20.0k	RES, 20.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0720KL	Yageo America		
R28	1	215k	RES, 215 k, 1%, 0.1 W, 0603	0603	RC0603FR-07215KL	Yageo America		
R60	1	60.4k	RES, 60.4 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE0760K4L	Yageo America		
R63	1	121k	RES, 121 k, 1%, 0.1 W, 0603	0603	CRCW0603121KFKEA	Vishay-Dale		
R66	1	100k	RES, 100 k, 5%, 0.0625 W, AEC-Q200 Grade 1, Resistor Array - 8x1	Resistor Array - 8x1	EXB-2HV104JV	Panasonic		
R68	1	20.0k	RES, 20.0 k, 1%, 0.1 W, 0603	0603	CRCW060320K0FKEA	Vishay-Dale		
R69, R72, R77, R82	4	1.20k	RES, 1.20 k, 1%, 0.1 W, 0603	0603	RC0603FR-071K2L	Yageo America		
R74, R79	2	34.8	RES, 34.8, 1%, 0.1 W, 0603	0603	RC0603FR-0734R8L	Yageo America		
R75, R80	2	10.0	RES, 10.0, 1%, 0.1 W, 0603	0603	RC0603FR-0710RL	Yageo America		
R86	1	0.047	RES, 0.047, 1%, 0.1 W, 0603	0603	ERJ-L03KF47MV	Panasonic		
R87	1	121k	RES, 121 k, 1%, 0.1 W, 0603	0603	RC0603FR-07121KL	Yageo America		
R97	1	7.68k	RES, 7.68 k, 1%, 0.1 W, 0603	0603	RC0603FR-077K68L	Yageo America		
R98	1	4.99k	RES, 4.99 k, 1%, 0.1 W, 0603	0603	CR0603-FX-4991ELF	Bourns		
R99	1	5.23k	RES, 5.23 k, 1%, 0.1 W, 0603	0603	CRCW06035K23FKEA	Vishay-Dale		
S3	1		Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch		
S4	1		Switch, Slide, SPST 8 poles, SMT	Switch, 8Pos, 21.8x3.8x6.7 mm	219-8MST	CTS Electrocomponents		
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, SH-J27	26	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP6, TP7, TP8, TP9, TP10, TP22, TP23, TP24	8	Double	Terminal, Turret, TH, Double	Keystone1573-2	1573-2	Keystone		

Table 9. ADS127L01 Bill of Materials[(1)] (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
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		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
U6, U9	2		8-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR FOR OPEN-DRAIN AND PUSH-PULL APPLICATIONS, RGY0020A	RGY0020A	TXS0108ERGYR	Texas Instruments		Texas Instruments
U7	1		Dual Inverter Buffer/Driver With Open-Drain Outputs, DCK0006A	DCK0006A	SN74LVC2G06DCKR	Texas Instruments		Texas Instruments
U8, U11	2		SINGLE BUFFER/DRIVER WITH OPEN-DRAIN OUTPUT, DCK0005A	DCK0005A	SN74LVC1G07DCKR	Texas Instruments	SN74LVC1G07DCKT	Texas Instruments
U10	1		Single Inverter Buffer/Driver With Open-Drain Output, DCK0005A	DCK0005A	SN74LVC1G06DCKR	Texas Instruments	SN74LVC1G06DCKT	Texas Instruments
U12	1		TINY 1.5-A BOOST CONVERTER WITH ADJUSTABLE INPUT CURRENT LIMIT, DSG0008A	DSG0008A	TPS61252DSGR	Texas Instruments	TPS61252DSGT	Texas Instruments
U13	1		36-V, 1-A, 4.17-uVRMS, RF LDO Voltage Regulator, RGW0020A	RGW0020A	TPS7A4700RGWR	Texas Instruments	TPS7A4700RGWT	Texas Instruments
U14	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
U15	1		3-Pin Voltage Supervisors with Active-Low, Open-Drain Reset, DBZ0003A	DBZ0003A	TLV803MDBZR	Texas Instruments	TLV803MDBZT	Texas Instruments
U16	1		1-A Low-Dropout Regulator With Reverse Current Protection, DRV0006A	DRV0006A	TPS73733DRVR	Texas Instruments	TPS73733DRVT	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	RGT0016A	THS4551IRGTR	Texas Instruments	THS4551IRGTT	Texas Instruments
U32	1		High-Precision Voltage Reference with Integrated High-Bandwidth Buffer, DGK0008A	DGK0008A	REF6025AIDGK	Texas Instruments		Texas Instruments
U35, U36	2		+36V, +150mA, Ultralow-Noise, Positive LINEAR REGULATOR, DGN0008D	DGN0008D	TPS7A4901DGNR	Texas Instruments	TPS7A4901DGNT	Texas Instruments
Y1, Y2	2		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		
C7, C8, C19, C20, C40, C49, C51, C55, C60, C85, C86, C91	0	0.1uF	CAP, CERM, 0.1 µF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX		
C39, C41, C43, C46, C47, C57, C58	0	10uF	CAP, CERM, 10 µF, 35 V, +/- 10%, X7R, 1206	1206	GMK316AB7106KL	Taiyo Yuden		
C42, C45, C50, C56, C61	0	0.01uF	CAP, CERM, 0.01 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E103KA01D	Murata		
C44, C93	0	1uF	CAP, CERM, 1 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E105KA12D	Murata		
C48, C59	0	10uF	CAP, CERM, 10 µF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	Murata		

Table 9. ADS127L01 Bill of Materials[(1)] (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
C52	0	1100pF	CAP, CERM, 1100 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H112JA01D	Murata		
C53	0	0.22uF	CAP, CERM, 0.22 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E224KA88D	Murata		
C54	0	10pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	06035A100JAT2A	AVX		
C62	0	4700pF	CAP, CERM, 4700 pF, 100 V, +/- 10%, X7R, 0603	0603	06031C472KAT2A	AVX		
C72	0	10pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H100JA01D	Murata		
C81	0	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	GRM1885C1H102FA01J	Murata		
C90	0	2.2uF	CAP, CERM, 2.2 µF, 35 V, +/- 10%, X5R, 0603	0603	GRM188R6YA225KA12D	Murata		
C92, C94	0	10uF	CAP, CERM, 10 µF, 25 V, +/- 20%, X5R, 0603	0603	GRM188R61E106MA73	Murata		
C95	0	47uF	CAP, CERM, 47 µF, 10 V, +/- 10%, X7R, 1210	1210	GRM32ER71A476KE15L	Murata		
C96	0	22uF	CAP, CERM, 22 µF, 35 V, +/- 20%, X5R, 0805	0805	C2012X5R1V226M125AC	TDK		
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	-	-
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.		
JP5	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		
R4, R6, R16, R41, R53, R93	0	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale		
R5, R7	0	100	RES, 100, 1%, 0.1 W, 0603	0603	CRCW0603100RFKEA	Vishay-Dale		
R17, R50	0	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale		
R31, R32, R34, R35, R70, R71, R81, R83, R84, R90, R94	0	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale		
R39	0	681	RES, 681, 1%, 0.1 W, 0603	0603	CRCW0603681RFKEA	Vishay-Dale		
R40	0	9.31k	RES, 9.31 k, 1%, 0.1 W, 0603	0603	CRCW06039K31FKEA	Vishay-Dale		
R42	0	3.01k	RES, 3.01 k, 1%, 0.1 W, 0603	0603	CRCW06033K01FKEA	Vishay-Dale		
R43	0	158k	RES, 158 k, 1%, 0.1 W, 0603	0603	CRCW0603158KFKEA	Vishay-Dale		
R44	0	453k	RES, 453 k, 1%, 0.1 W, 0603	0603	CRCW0603453KFKEA	Vishay-Dale		
R45	0	51.1k	RES, 51.1 k, 1%, 0.1 W, 0603	0603	CRCW060351K1FKEA	Vishay-Dale		
R46	0	49.9k	RES, 49.9 k, 1%, 0.1 W, 0603	0603	CRCW060349K9FKEA	Vishay-Dale		

Table 9. ADS127L01 Bill of Materials[(1)] (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R47	0	15.0k	RES, 15.0 k, 1%, 0.1 W, 0603	0603	CRCW060315K0FKEA	Vishay-Dale		
R48	0	121k	RES, 121 k, 1%, 0.1 W, 0603	0603	CRCW0603121KFKEA	Vishay-Dale		
R49	0	10.0	RES, 10.0, 1%, 0.1 W, 0603	0603	CRCW060310R0FKEA	Vishay-Dale		
R51	0	1.30Meg	RES, 1.30 M, 1%, 0.1 W, 0603	0603	CRCW06031M30FKEA	Vishay-Dale		
R52	0	93.1k	RES, 93.1 k, 1%, 0.1 W, 0603	0603	CRCW060393K1FKEA	Vishay-Dale		
R56, R61, R62, R85, R102	0	1.00Meg	RES, 1.00 M, 1%, 0.1 W, 0603	0603	CRCW06031M00FKEA	Vishay-Dale		
R91	0	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	CRCW06031K00FKEA	Vishay-Dale		
R92, R95	0	0.22	RES, 0.22, 1%, 0.1 W, 0603	0603	ERJ-3RQFR22V	Panasonic		
S1, S2	0		Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch		
SH-J4	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
U4	0		8-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR FOR OPEN-DRAIN AND PUSH-PULL APPLICATIONS, RGY0020A	RGY0020A	TXS0108ERGYR	Texas Instruments		Texas Instruments
U5	0		SINGLE BUFFER/DRIVER WITH OPEN-DRAIN OUTPUT, DCK0005A	DCK0005A	SN74LVC1G07DCKR	Texas Instruments	SN74LVC1G07DCKT	Texas Instruments
U17	0		1.5-A LOW-NOISE FAST-TRANSIENT-RESPONSE LOW-DROPOUT REGULATOR, DCQ0006A	DCQ0006A	TL1963ADCQR	Texas Instruments	TL1963ADCQT	Texas Instruments
U18	0		3-PIN VOLTAGE SUPERVISORS, DBV0003A	DBV0003A	TPS3809I50QDBVRQ1	Texas Instruments		Texas Instruments
U19	0		Single Inverter Buffer/Driver With Open-Drain Output, DCK0005A	DCK0005A	SN74LVC1G06DCKR	Texas Instruments	SN74LVC1G06DCKT	Texas Instruments
U20	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
U21	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
U22	0		DC-DC INVERTER, DRC0010J	DRC0010J	TPS63700DRCR	Texas Instruments	TPS63700DRCT	Texas Instruments
U23	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
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 16 and Figure 17 illustrate the PCB layouts.

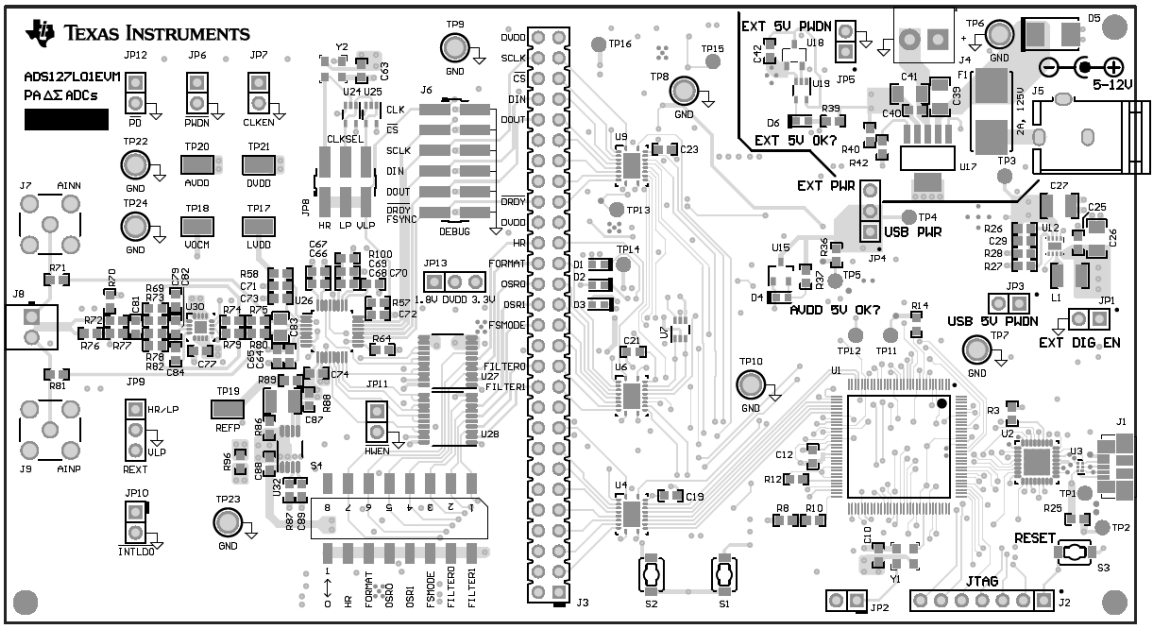


Figure 16. PCB Layout - Top

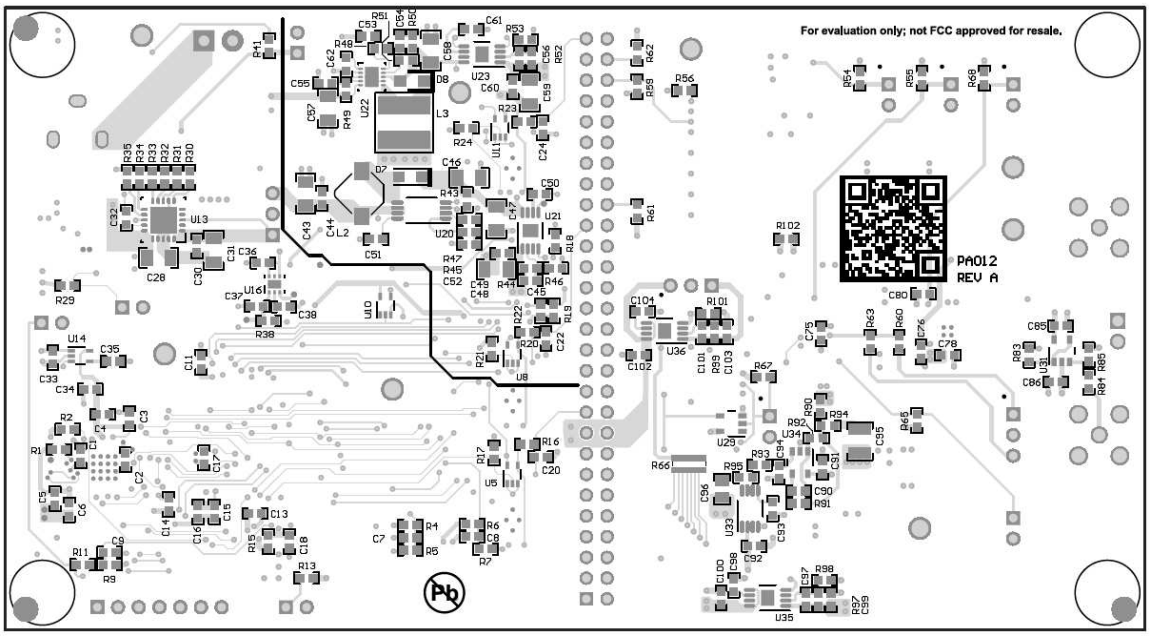
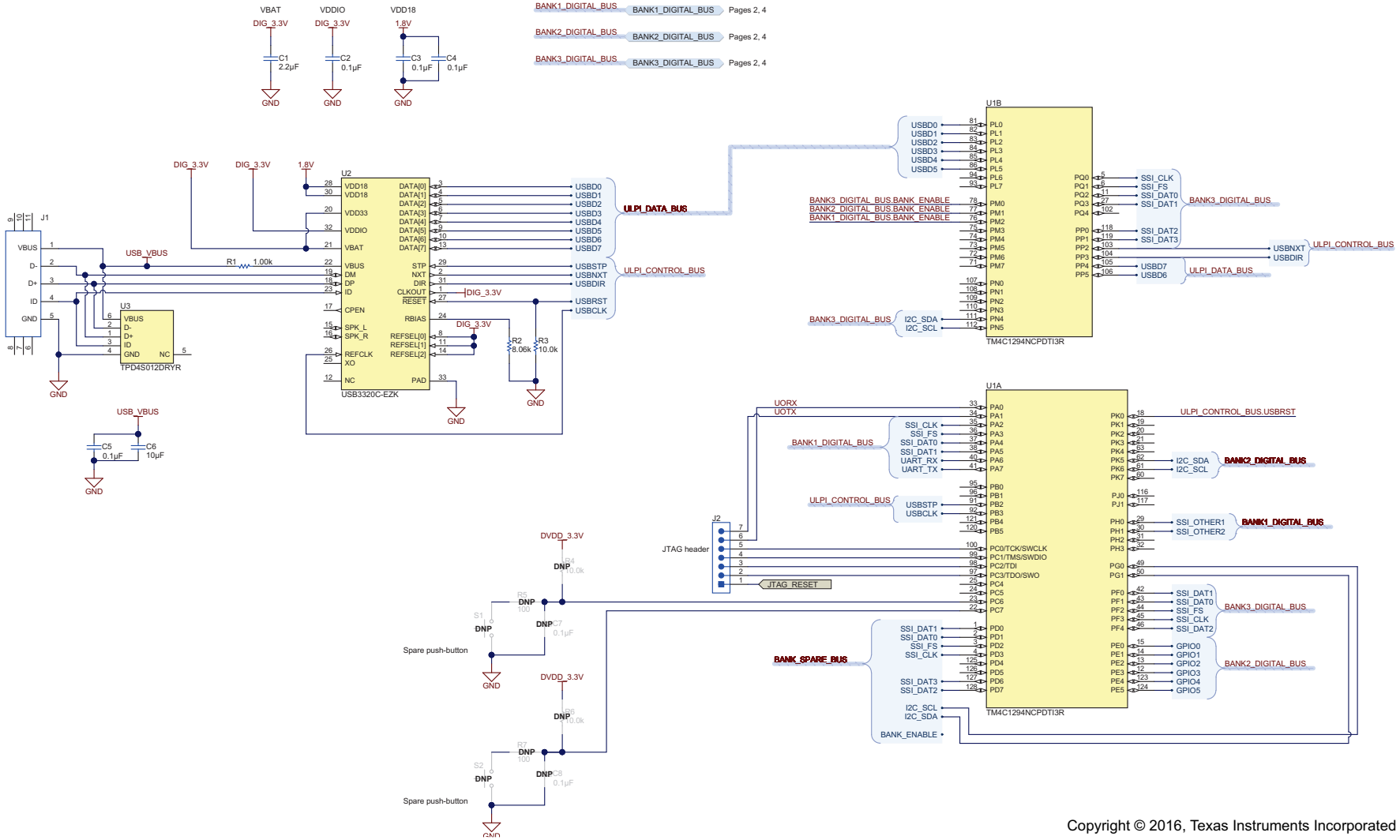


Figure 17. PCB Layout - Bottom

7.3 Schematic

Figure 18 through Figure 26 illustrate the EVM schematics.



Copyright © 2016, Texas Instruments Incorporated

Figure 18. TM4C Main Schematic

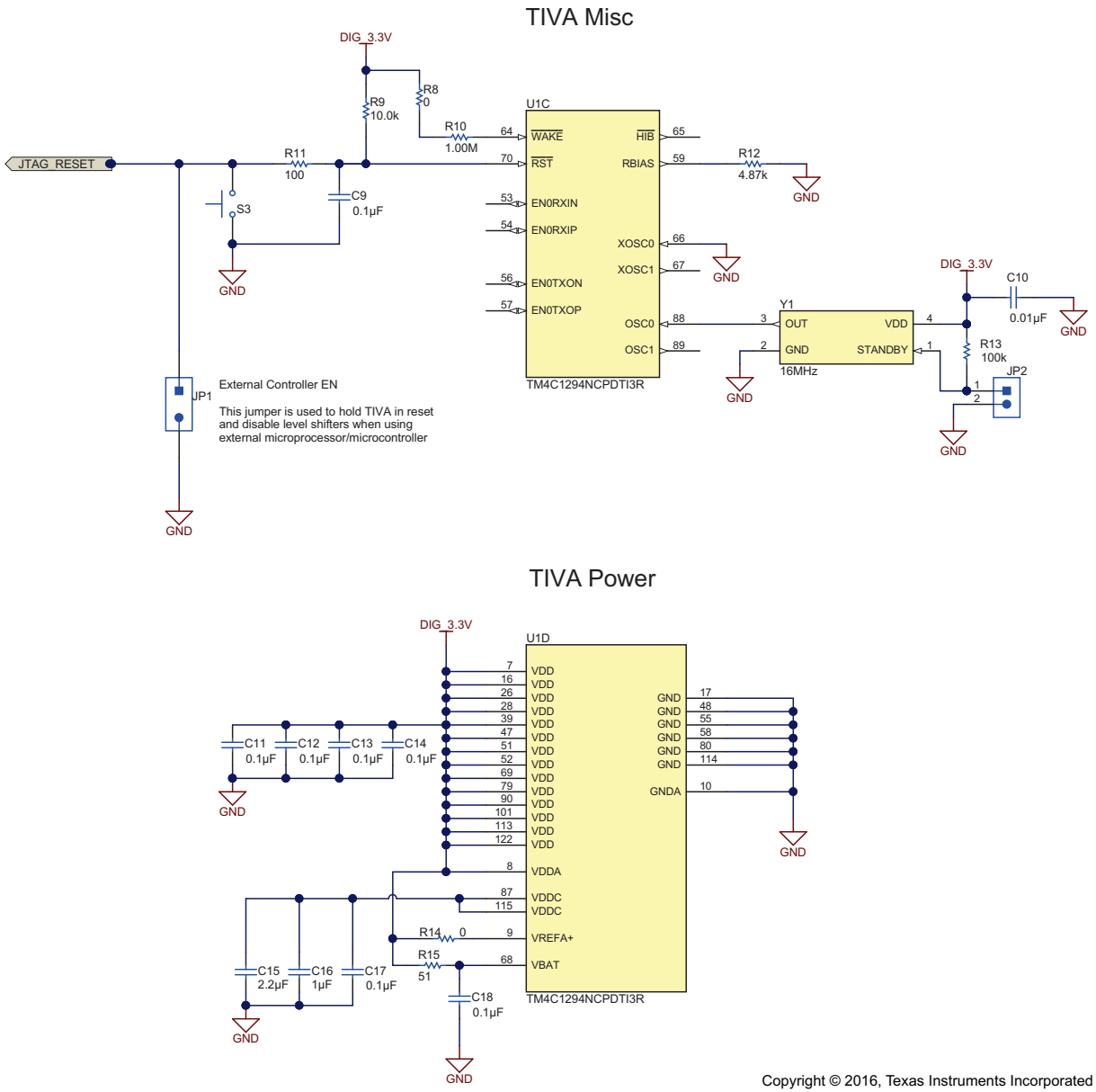


Figure 19. TM4C Miscellaneous and Power Schematic

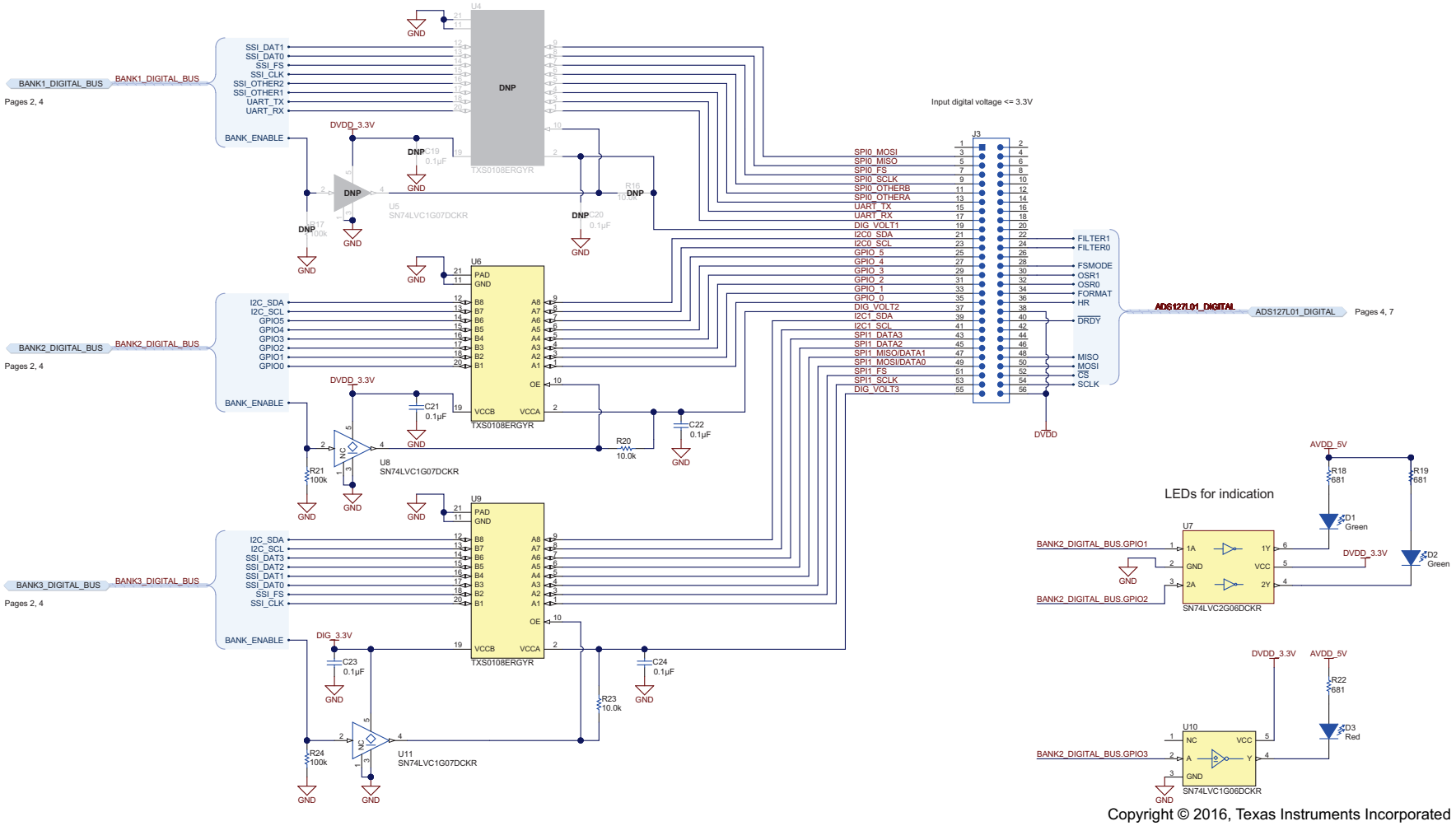
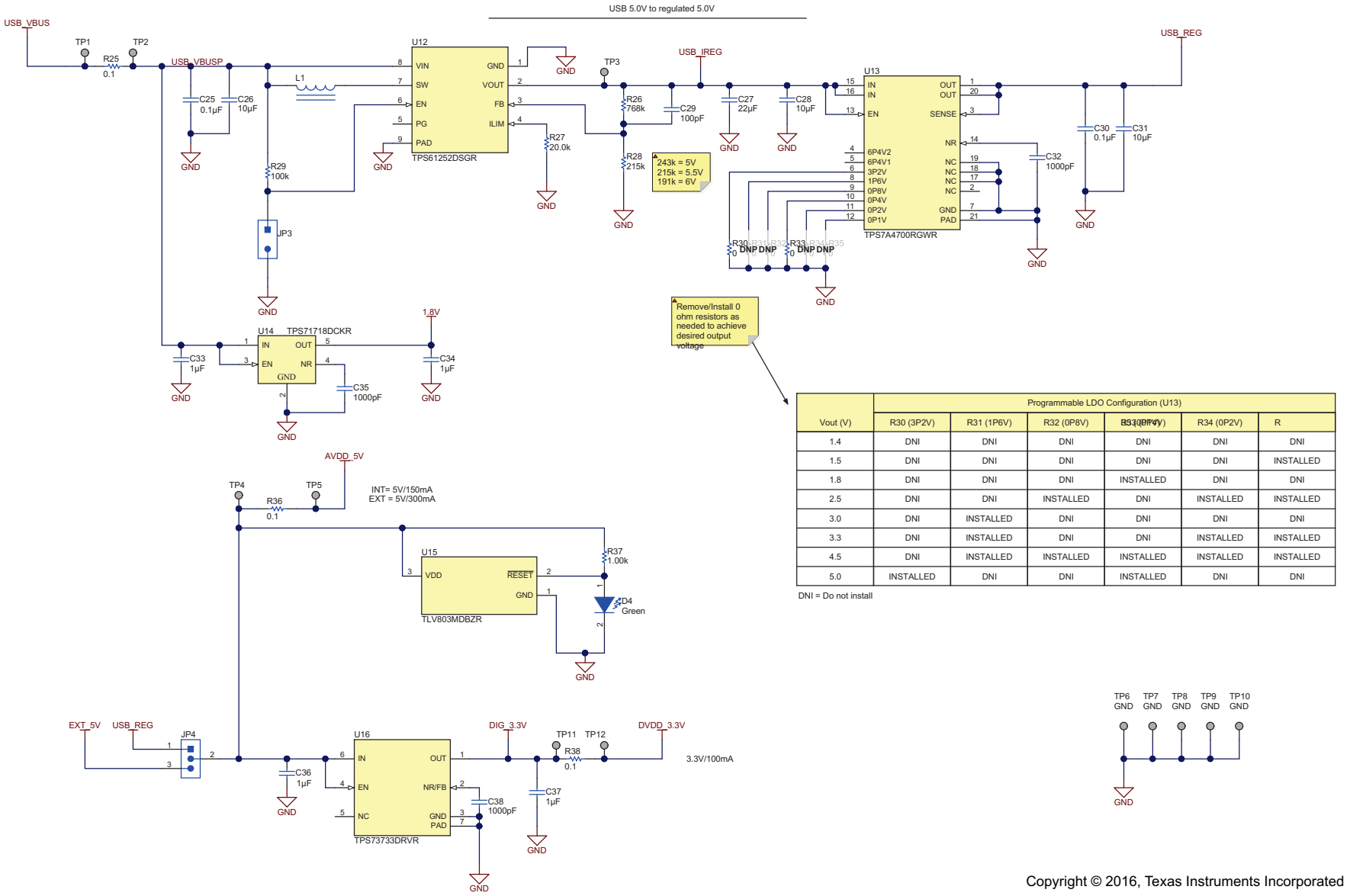


Figure 20. ADS127L01EVM Digital Header Schematic



Vout (V)	Programmable LDO Configuration (U13)					
	R30 (3P2V)	R31 (1P6V)	R32 (0P8V)	R33 (0P4V)	R34 (0P2V)	R
1.4	DNI	DNI	DNI	DNI	DNI	DNI
1.5	DNI	DNI	DNI	DNI	DNI	INSTALLED
1.8	DNI	DNI	DNI	INSTALLED	DNI	DNI
2.5	DNI	DNI	INSTALLED	DNI	INSTALLED	INSTALLED
3.0	DNI	INSTALLED	DNI	DNI	DNI	DNI
3.3	DNI	INSTALLED	DNI	DNI	INSTALLED	INSTALLED
4.5	DNI	INSTALLED	INSTALLED	INSTALLED	INSTALLED	INSTALLED
5.0	INSTALLED	DNI	DNI	INSTALLED	DNI	DNI

DNI = Do not install

Figure 21. ADS127L01EVM USB Power Schematic

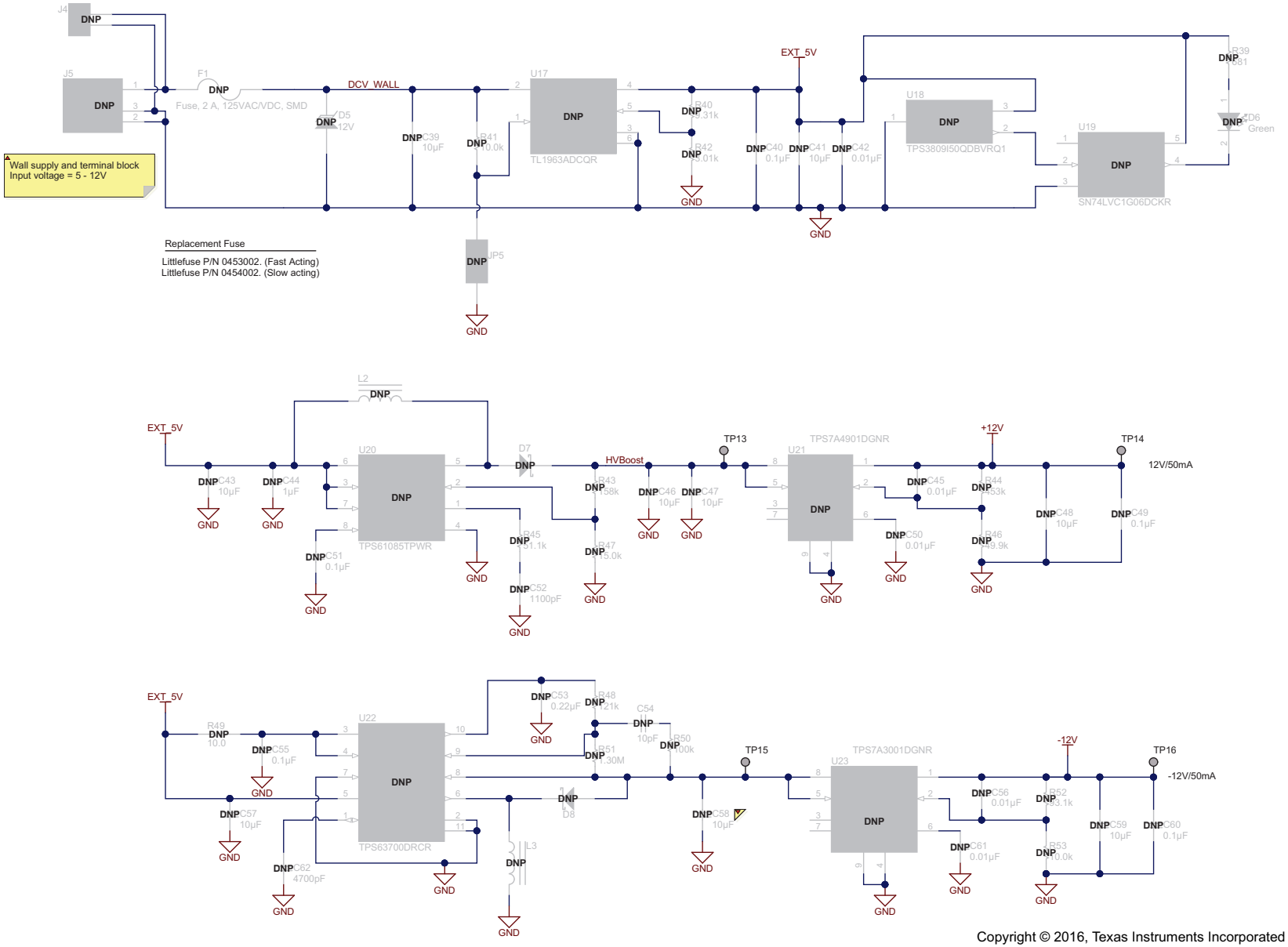
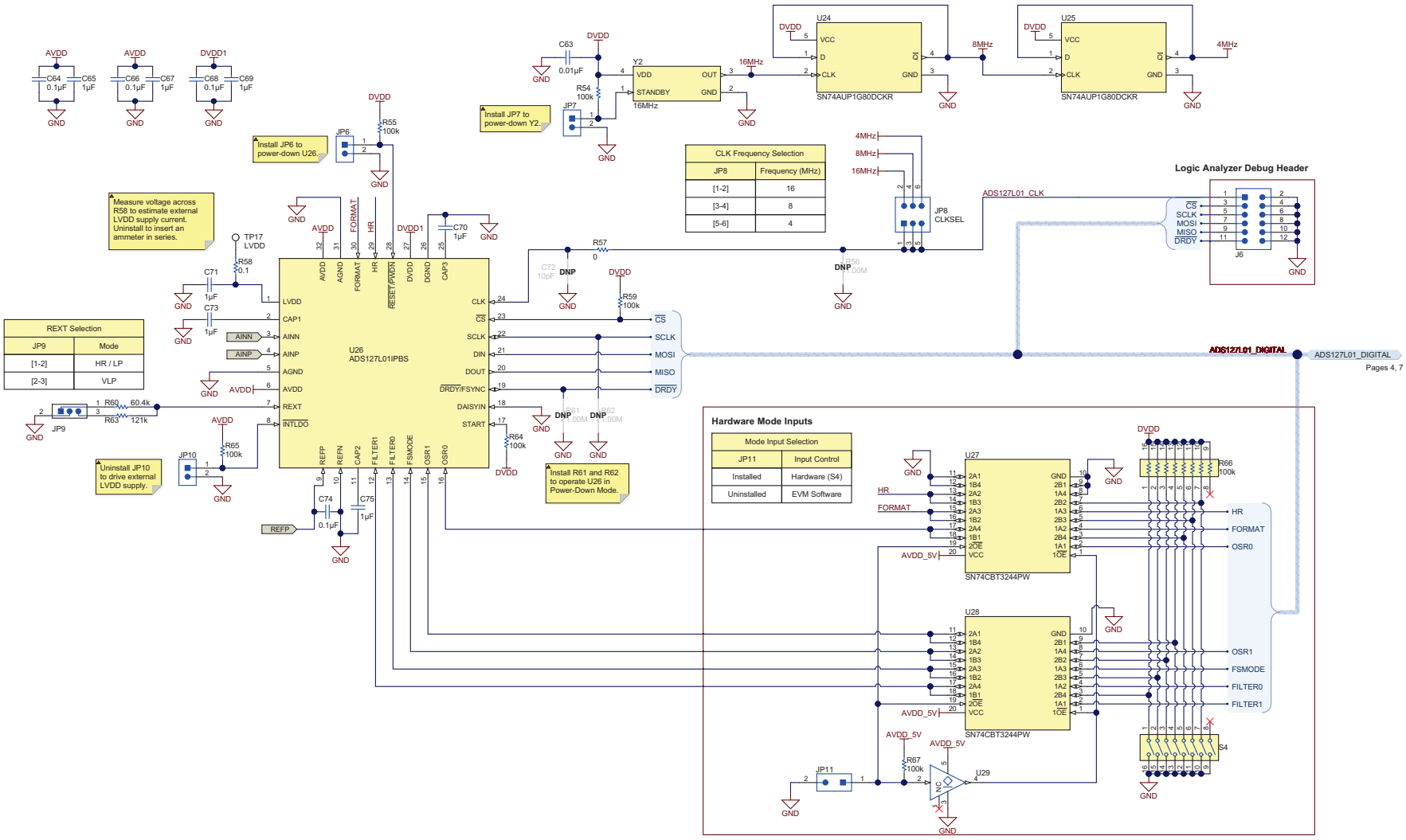


Figure 22. ADS127L01EVM External Power Schematic

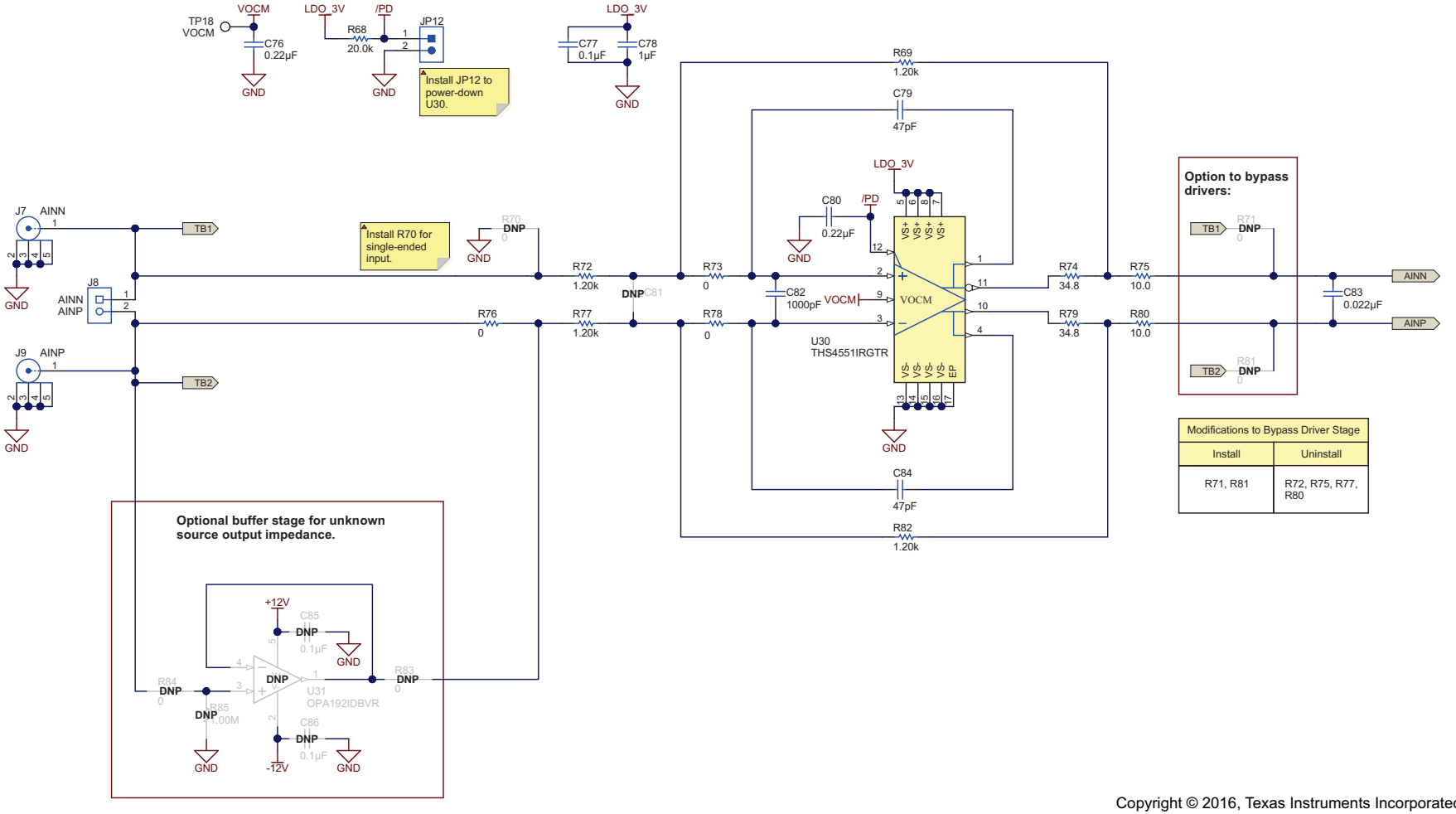


Copyright © 2016, Texas Instruments Incorporated

Figure 23. ADS127L01EVM ADC Main Schematic

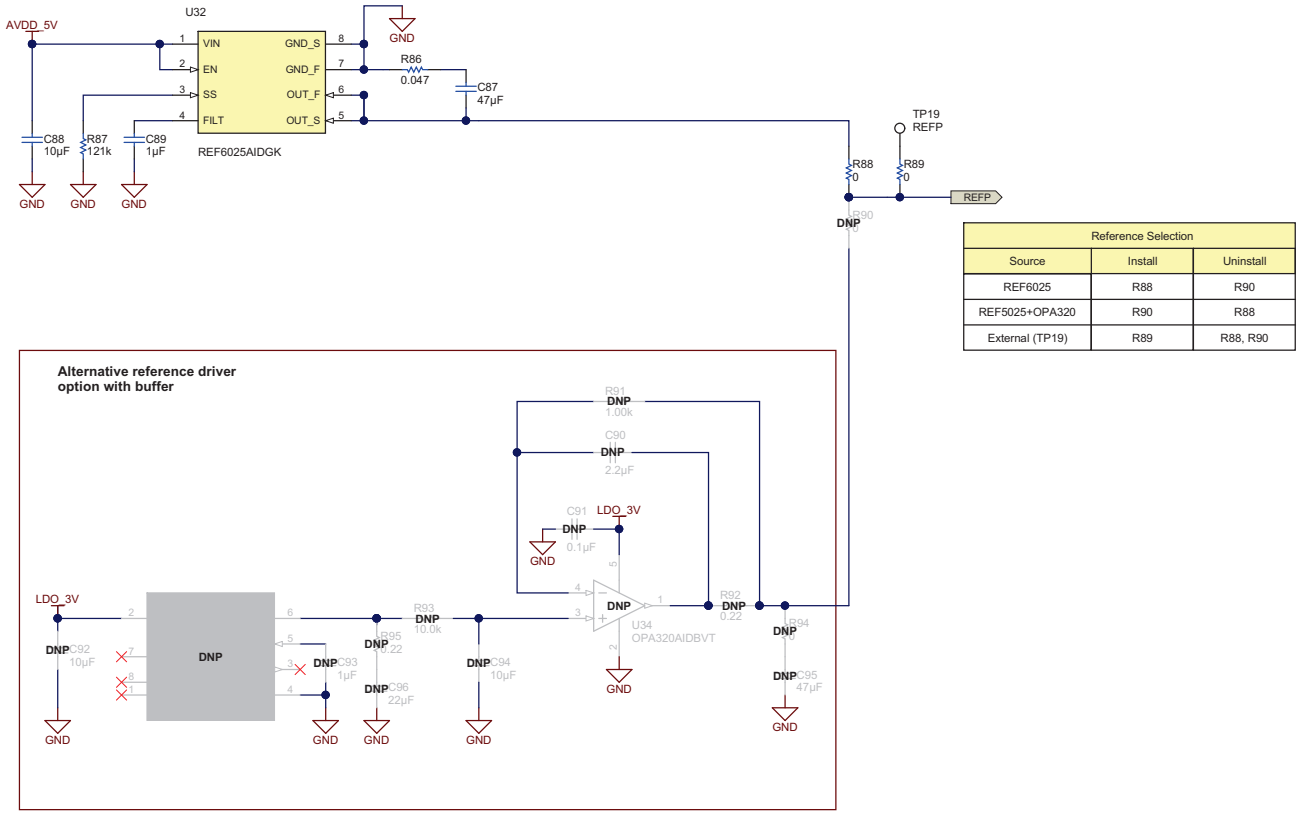
Alternate Driver Options				
U30	Gain Bandwidth Product (MHz)	Noise Density (nV/√Hz)	Quiescent Current Iq (mA)	Rf, Rg (Ω) (R69, R72, R77, R82)
THS4531A	36	10	0.23	2k
THS4541	850	2.2	9.7	402
THS4551	130	3.4	1.35	1.2k

Performance may vary with alternate drivers.



Modifications to Bypass Driver Stage	
Install	Uninstall
R71, R81	R72, R75, R77, R80

Figure 24. ADS127L01EVM ADC Input Driver Schematic



Reference Selection		
Source	Install	Uninstall
REF6025	R88	R90
REF5025+OPA320	R90	R88
External (TP19)	R89	R88, R90

Figure 25. ADS127L01EVM ADC Reference Schematic

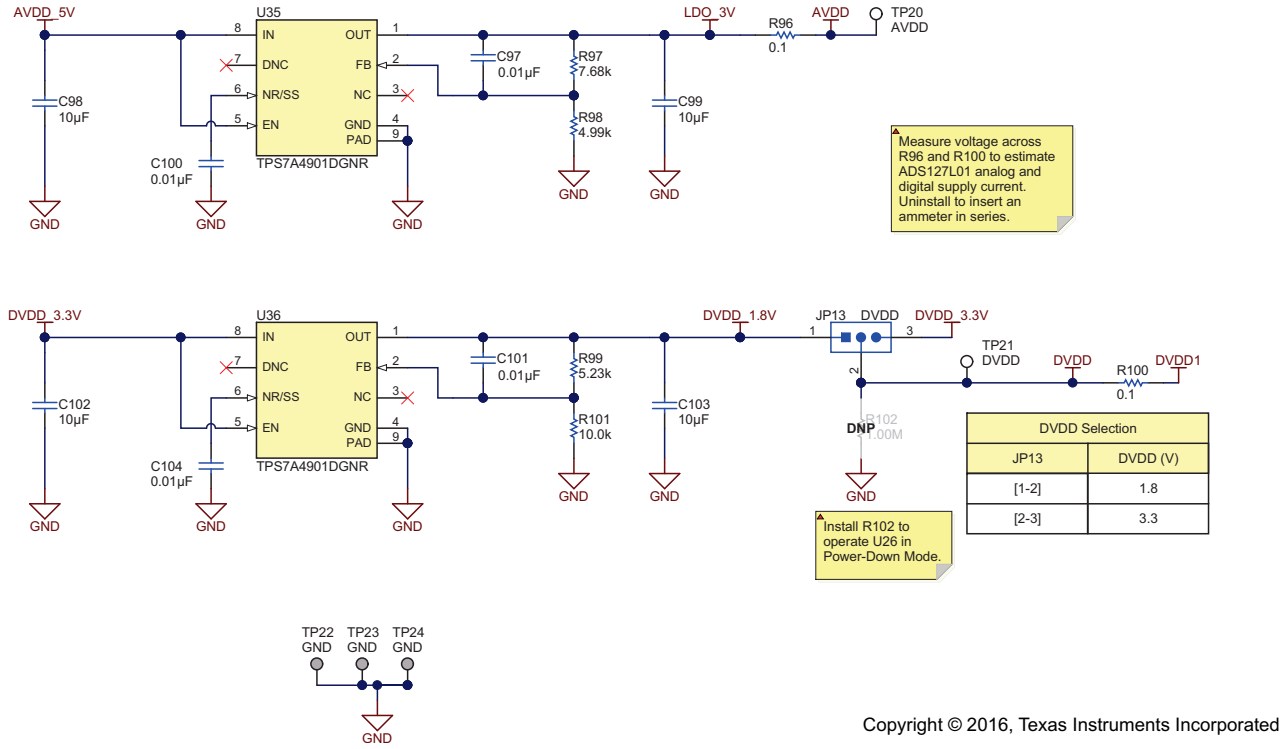


Figure 26. ADS127L01EVM ADC Power Schematic

Revision History

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

Changes from Original (May 2016) to A Revision	Page
• Added **NOTE:** to the *Clock Inputs* section.	15

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

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

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

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

2 *Limited Warranty and Related Remedies/Disclaimers*:

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

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

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

3 *Regulatory Notices:*

   3.1 *United States*

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

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

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

      CAUTION

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

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

      FCC Interference Statement for Class A EVM devices

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

FCC Interference Statement for Class B EVM devices

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

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

3.2 *Canada*

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

Concerning EVMs Including Radio Transmitters:

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

Concernant les EVMs avec appareils radio:

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

Concerning EVMs Including Detachable Antennas:

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

Concernant les EVMs avec antennes détachables

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

3.3 *Japan*

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

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

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

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

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

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

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

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

東京都新宿区西新宿６丁目２４番１号

西新宿三井ビル

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

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

4 *EVM Use Restrictions and Warnings:*

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

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

4.3 *Safety-Related Warnings and Restrictions:*

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

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

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

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

6. *Disclaimers:*

   6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

   6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND CONDITIONS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS ANDCONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265