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Evaluation Board for the Dual, Continuous Time Sigma-Delta Modulator

EVALUATION BOARD DESCRIPTION

The AD9267 evaluation board serves two purposes: as an evaluation platform for the 16-bit, dual, continuous time sigma-delta (Σ-Δ) modulator and as a direct conversion demonstration platform. Table 1 lists the product features of all the Analog Devices, Inc., components in the demonstrator.

The AD9267 is a dual continuous time Σ-Δ modulator with −88 dBc of dynamic range over 10 MHz real or 20 MHz complex bandwidth. The combination of high dynamic range, wide bandwidth, and characteristics unique to the continuous time Σ-Δ modulator architecture makes the AD9267 an ideal solution for wireless communication systems.

Direct conversion architectures, as shown in Figure 1, use a single frequency translation step to convert the RF channel directly to baseband without any intermediate frequency stages. The frequency translation in this direct conversion demonstrator is accomplished by the ADL5382, which is a quadrature demodulator. The ADL5382 covers the frequency range between 700 MHz and 2.7 GHz.

The AD9267 has passive inputs, therefore allowing the ADL5382 to directly drive the modulator. The AD9267 does not require a filter preceding the converter because the continuous time Σ-Δ architecture possesses inherent antialiasing capabilities. Therefore, minimal or no filtering is required between the demodulator and the AD9267. A prototype area for a fourth-order filter is provided in which additional filtering can be tested.

To achieve optimal performance from the AD9267, a low jitter differential clock is necessary, and the AD9516 family of parts offers superior clock performance. The AD9516-0 and a crystal oscillator footprint are included on the evaluation board. In addition to providing a clock option to the modulator, the many outputs from the AD9516 can be used to drive other external capture devices. AD9516 is used throughout to refer to all the members of the AD9516 family. However, the use of AD9516-0 refers to that specific device.

The ADR130B offers the option of using an external 0.5 V band gap reference voltage for the AD9267. The ADP3339 provides a quiet and reliable voltage source to each of the Analog Devices components.

In addition to offering system-level evaluation of the direct conversion architecture, the evaluation board offers the flexibility of isolating the AD9267 from the surrounding components, enabling a detailed evaluation of only the AD9267. The modulator inputs can be disconnected from the ADL5382 and be driven with an external source. The analog inputs of the AD9267 can be driven from either a differential transformer or the ADA4937-2, which is a very low noise, high linearity differential amplifier.

Complementing the AD9267 evaluation board are additional hardware and software to capture and process digital data from the output of the modulator. The AD9267 can only be evaluated using the HSC-ADC-EVALCZ high speed ADC data capture card in conjunction with the VisualAnalog™ data capture and analysis software. The SPIController™ software is used to read and write to the AD9267.

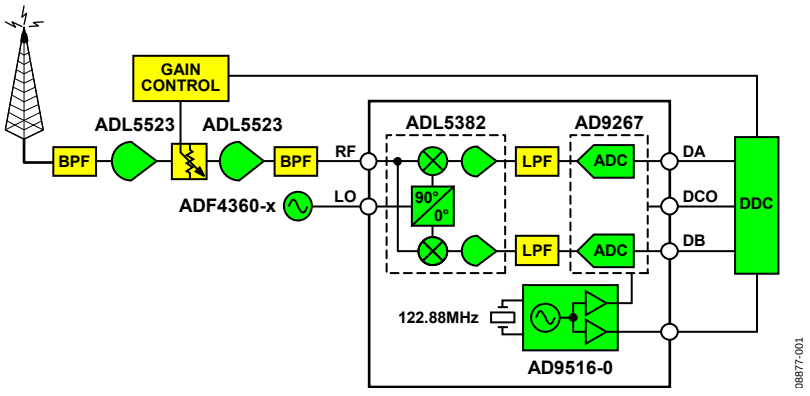


Figure 1. Direct Conversion Receiver Block Diagram

TABLE OF CONTENTS

Evaluation Board Description 1
Revision History 2
Product Features 3
Getting Started 4
Configuring the Evaluation Board 5
Clock 5
Receiver Input Configuration 5
Modulator Only Input Configuration 5
Differential Transformer Path 6
Amplifier Driver Path 6
Power-Down Settings 6
Digital Output 6
Supporting Hardware and Software 7
Software 7
Hardware 7
AD9267 SPI Controller 7
AD9516 SPI Controller 7
AD9516 Register Settings 8
VisualAnalog Overview 9
Loading Binary Files into the FPGA 9
Schematics 11
Layout 16
Ordering Information 20
Bill of Materials 20
Related Links 23

REVISION HISTORY

3/10—Revision 0: Initial Version

PRODUCT FEATURES

Table 1.

AD9267	ADL5382	AD9516-0
SNR: 83 dB (85 dBFS) to 10 MHz input SFDR: −88 dBc to 10 MHz input Noise figure: 15 dB Input impedance: 1 kΩ Power: 416 mW 10 MHz real or 20 MHz complex bandwidth 1.8 V analog supply operation On-chip PLL clock multiplier On-chip voltage reference Twos complement data format 640 MSPS, 4-bit LVDS data output Serial control interface (SPI)	I-Q demodulator Operating RF frequency: 700 MHz to 2.7 GHz IIP3: 33.5 dBm at 900 MHz IIP2: >70 dBm at 900 MHz Input P1dB: 14.7 dBm at 900 MHz Noise figure: 14 dB at 900 MHz Voltage conversion gain: ~4 dB Quadrature demodulation accuracy Phase accuracy: ~0.2° Amplitude balance: ~0.05 dB LO input: −6 dBm to +6 dBm Demodulation bandwidth: ~370 MHz I/Q drive 2 V p-p into 200 Ω Programmable power consumption	Low phase noise, phase-locked loop On-chip VCO tunes from 2.55 GHz to 2.95 GHz External VCO/VCXO to 2.4 GHz (optional) One differential or two single-ended reference inputs Reference monitoring capability Auto and manual reference switchover/holdover modes Autorecover from holdover Accepts references to 250 MHz Programmable delays in path to PFD Digital or analog lock detect, selectable Three pairs of 1.6 GHz LVPECL outputs Each pair shares one to 32 dividers with coarse phase delay Additive output jitter: 225 f_S rms Channel-to-channel skew paired outputs: <10 ps Two pairs of 800 MHz LVDS clock outputs Each pair shares two cascaded one-to-32 dividers with coarse phase delay Additive output jitter: 275 f_S rms Fine delay adjust (ΔT) on each LVDS output Eight 250 MHz CMOS outputs (two per LVDS output) Automatic synchronization of all outputs on power-up Manual synchronization of outputs as needed Serial control port 64-lead LFCSP
ADR130B	**ADP3339**	**ADA4937-2**
Initial accuracy A grade: ±0.70% (maximum) B grade: ±0.35% (maximum) Maximum temperature coefficient A grade: 50 ppm/°C B grade: 25 ppm/°C C_{LOAD}: 50 nF to 10 µF Output current: +4 mA/−2 mA Low operating current: 80 µA (typical) Output noise: 6 µV p-p at 1.0 V output Input range: 2.0 V to 18 V Temperature range: −40°C to +125°C Tiny, Pb-free TSOT package	High accuracy over line and load: ±0.9% at 25°C, ±1.5% over temperature Ultralow dropout voltage: 230 mV (typical) at 1.5 A Requires only C_O = 1.0 µF for stability anyCAP® regulators: stable with any type of capacitor (including MLCC) Current and thermal limiting Low noise 2.8. V to 6 V supply range −40°C to +85°C ambient temperature range SOT-223 package	Extremely low harmonic distortion −112 dBc HD2 at 10 MHz −84 dBc HD2 at 70 MHz −77 dBc HD2 at 100 MHz −102 dBc HD3 at 10 MHz −91 dBc HD3 at 70 MHz −84 dBc HD3 at 100 MHz Low input voltage noise: 2.2 nV/√Hz High speed −3 dB bandwidth of 1.9 GHz, G = 1 Slew rate: 6000 V/µs, 25% to 75% 0.1 dB gain flatness to 200 MHz Fast overdrive recovery of <1 ns ±0.5 mV typical offset voltage Externally adjustable gain Differential-to-differential or single-ended–to-differential operation Adjustable output common-mode voltage Single-supply operation: 3.3 V to 5 V Pb-free, 3 mm × 3 mm 16-lead LFCSP

GETTING STARTED

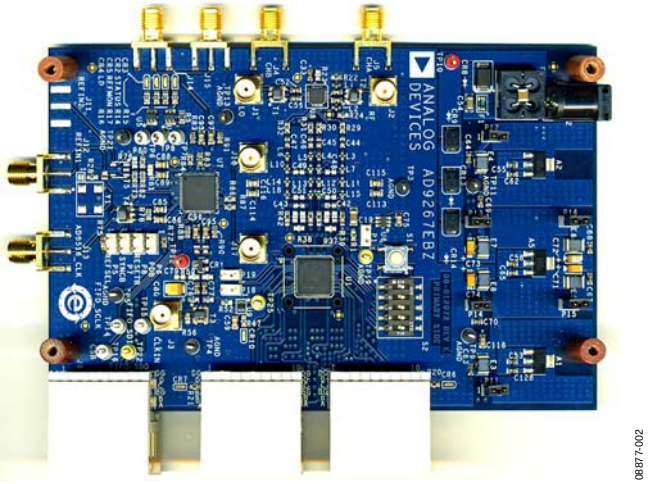


Figure 2. Evaluation Board Front

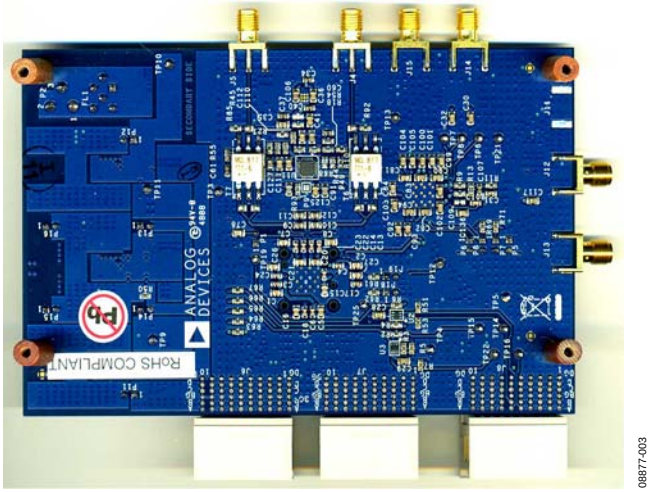


Figure 3. Evaluation Board Back

The default configuration of the AD9267 evaluation board allows a quick and easy start to evaluating the direct conversion receiver subsystem. The default configuration interfaces the ADL5382 directly with the AD9267. Table 2 and Figure 4 show the hardware required to start the evaluation.

Table 2. Quick Start Hardware Requirements

Name	Board	Value	Reference Designator
Power	AD9267EBZ	+6.0 V	P2
	HSC-ADC-EVALCZ	+5.0 V	
Clock	AD9267EBZ	640 MHz	J3
RF Input	AD9267EBZ	700 MHz to 2.7 GHz	J2
LO Input	AD9267EBZ	−6 dBm to +6 dBm	J1
USB	HSC-ADC-EVALCZ	N/A	

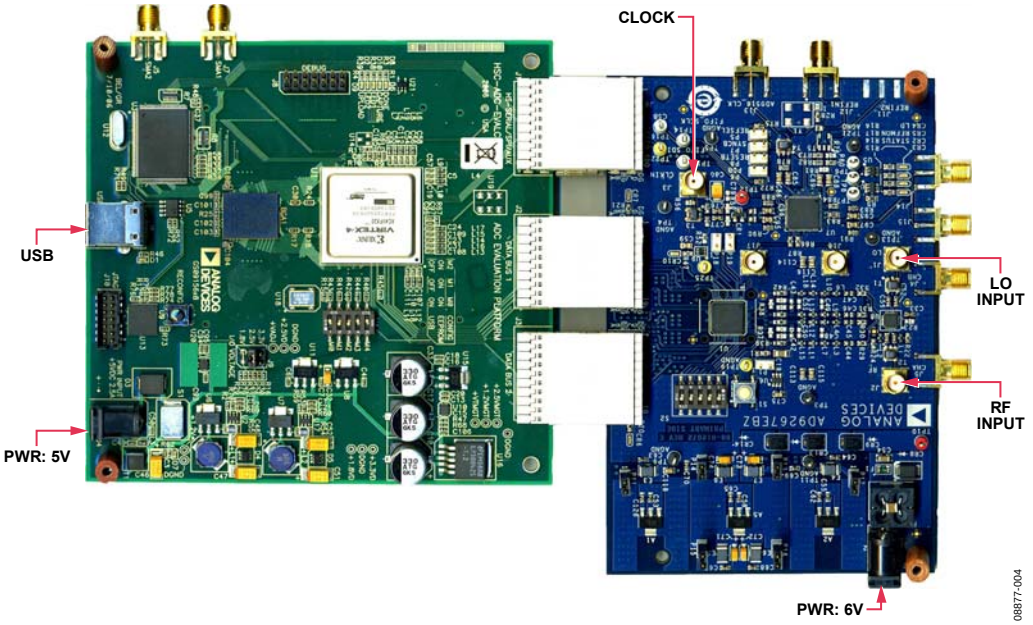


Figure 4. Quick Start Configuration

CONFIGURING THE EVALUATION BOARD

Power is provided to the evaluation board by a single +6.0 V source applied to P2. The power source is regulated down to the appropriate levels by the ADP3339 voltage regulators. Table 3 shows the necessary voltage levels for each component.

Table 3. Component Power Supplies

Component	Power Supply
AD9267	1.8 V
ADL5382	5.0 V
AD9516-0	3.3 V

CLOCK

The AD9267 evaluation board offers many clocking options: a high frequency external clock can be applied directly to the modulator; the AD9516-0 LVPECL or CMOS clock can be used; and a low frequency clock, in conjunction with the integrated PLL from either the AD9516-0 or AD9267, can provide the necessary input clock frequency. The default clock option is configured for an external clock rate of 640 MHz.

The AD9267 evaluation board includes the footprint for a Valpey Fisher VFAC3 crystal oscillator. The crystal oscillator can serve as the reference clock to the AD9516-0, and the chip's internal PLL can be used to generate a clock closest to the desired frequency for the modulator. For example, a 122.88 MHz reference produces a VCO frequency of 2.580 GHz.

The AD9516-0 possesses an integrated VCO. The VCO frequency is further divided down by 4 to generate an output clock of 645 MHz, which serves as the input clock to the modulator. To optimize the AD9516-0 for this particular frequency, the loop filter must be configured as shown in Figure 5.

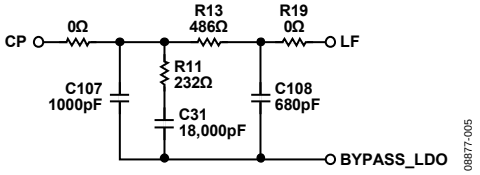


Figure 5. AD9516-0 Loop Filter

If the user chooses an alternative crystal oscillator frequency, the loop filter components must be configured appropriately. Some common crystal oscillators and the corresponding loop filter components are shown in Table 4. Refer to the ADIsimCLK software for design guidance.

Table 4. AD9516-0 Clock Configuration

Crystal (MHz)	Loop Filter					AD9267 Clock
	C107	R11	C31	R13	C108	
134.4	1000 pF	232 Ω	18,000 pF	486 Ω	680 pF	672 MHz
122.88	1000 pF	280 Ω	15,000 pF	576 Ω	560 pF	645.12 MHz
39.3216	1500 pF	221 Ω	22,000 pF	453 Ω	680 pF	648.8 MHz

To configure the evaluation board for either the external clock source or the AD9516-0 requires modifying the JP5 and JP6 solder jumpers. The AD9267 sets the common-mode level of the input clock to 450 mV; therefore, the clock source should be ac-coupled to the modulator input clock pins. Use the AD9516-0 software to configure the chip to the appropriate divide ratios.

RECEIVER INPUT CONFIGURATION

The default configuration uses the complex output signals of the I/Q demodulator as the input signals to the AD9267. In this configuration, the RF input signal should be applied to J2 and the LO signal to J1. The RF input range of the ADL5382 is limited to between 700 MHz and 2.7 GHz. The single-ended RF and LO signals are converted to differential signals using the RF transformers, T2 and T1. The resulting output signals of the demodulator are differential I and Q signals that can be directly applied to the resistive inputs of the AD9267, and no driver amplifiers are required.

Between the output of the ADL5382 and the input to the AD9267 are space holders for a fourth-order filter (see Figure 6). This filter may or may not be necessary depending on the application.

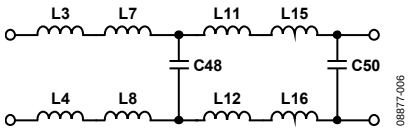


Figure 6. Fourth-Order Filter

MODULATOR ONLY INPUT CONFIGURATION

In addition to using the ADL5382 as an input source to the modulator, the AD9267 can be driven with an external source through either the ADA4937-2 or a differential transformer.

To configure the evaluation board for an external source, follow the hardware configuration shown in Table 5. The SMA connectors, labeled J5 and J4, correspond to the input signals to Channel A and Channel B, respectively, of the AD9267.

Additionally, short TP17, TP23, TP2, and TP24 to the appropriate pads to route the external signals to the input pins of the AD9267 (see Figure 7). This configuration requires careful attention to ensure that the output signals of the ADL5382 are disconnected and only the signals from the transformer or ADA4937-2 are routed to the modulator.

Table 5. External Modulator Input Configuration

Connector	Setting	Notes
J4, J5	N/A	J4: Channel B J5: Channel A
R33 to 42	DNP	Disconnect ADL5382 outputs from the AD9267
TP17	Short to the closest pad on R40	Connect A+ path
TP23	Short to the closest pad on R39	Connect A− path
TP2	Short to the closest pad on R42	Connect B+ path
TP24	Short to the closest pad on R41	Connect B− path

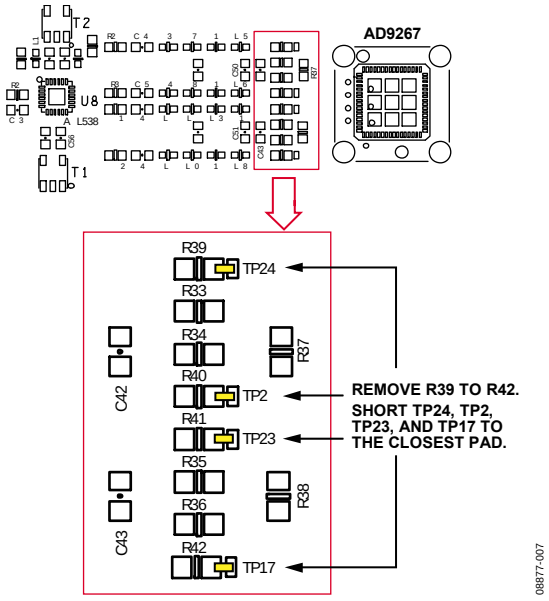


Figure 7. External Modulator-Only Jumper Settings

DIFFERENTIAL TRANSFORMER PATH

To activate the differential transformer path, follow the jumper configuration shown in Table 6.

Table 6. Differential Transformer Configuration

Jumper	Setting	Notes
JP1, JP2	Short Position 1 and Position 2	Configure SMA connectors for transformer inputs
JP3 to JP6	Short Position 2 and Position 3	Configure differential transformer outputs to modulator inputs

AMPLIFIER DRIVER PATH

Follow the jumper settings shown in Table 7.

Table 7. ADA4937-2 Configuration

Jumper	Setting	Notes
JP1, JP2	Short Position 2 and Position 3	Configure SMA connectors for ADA4937-2 inputs
JP3 to JP6	Short Position 1 and Position 2	Configure outputs from the ADA4937-2 to modulator inputs

POWER-DOWN SETTINGS

To power down the AD9267, Pin 3 and/or Pin 4 of the DUT must be tied high. This is accomplished on the evaluation board by shorting P18 and P19.

DIGITAL OUTPUT

The digital output of the AD9267 consists of a 4-bit LVDS data line at an output data rate of 640 MSPS. The output data is available directly from the continuous time Σ-Δ modulator, and there is no postprocessing of the digital data. Unlike the AD9262, the AD9267 does not have integrated decimation filters or a sample rate converter; therefore, the output is constrained to the high output data rate of 640 MSPS.

As an evaluation tool, decimation filters or any additional digital postprocessing can be coded into the FPGA available on the HSC-ADC-EVALCZ high speed ADC data capture card. The high speed ADC capture card currently supports Xilinx Virtex 4. Included in the evaluation board package are two binary files: the default file allows the modulated output data to be captured at 640 MSPS, and the second file incorporates the decimation filters within the FPGA code.

SUPPORTING HARDWARE AND SOFTWARE

The AD9267 can only be evaluated using the HSC-ADC-EVALCZ high speed ADC data capture card in conjunction with the VisualAnalog data capture and analysis software. The SPIController software is used to configure the AD9267 and the AD9516 to the appropriate register settings.

SOFTWARE

Manuals for VisualAnalog, the SPIController software, and the HSC-ADC-EVALCZ data capture hardware are included on the CD in the evaluation board package. It is recommended that the software be installed before connecting the hardware. VisualAnalog relies on the Microsoft .NET Framework Version 2, which is also included on the package CD. The .NET framework should be installed before installing VisualAnalog. The SPIController software should also be installed.

HARDWARE

The AD9267 evaluation board and the HSC-ADC-EVALCZ data capture card are powered from a wall-connected switching power supply. The switching power supplies have different output voltages; connect the 6.0 V power supply to the AD9267 evaluation board and the 5.0 V power supply to the HSC-ADC-EVALCZ data capture board. With the HSC-ADC-EVALCZ data capture board powered on and the VisualAnalog software installed, connect the USB cable to the PC and follow all the **Found new hardware** prompts, using the default driver each time.

AD9267 SPI CONTROLLER

Upon successful software installation and hardware setup, start the AD9267 SPIController software. By default, the software recognizes the AD9267 evaluation board and loads the correct SPIController profile. If it does not, from the **File** menu, click **Open**, then **Browse** to select the following file: **AD9267_16Bit_10MSspiR03.cfg**.

The AD9267 SPIController has four tabs. When correctly configured, a message appears in the **CHIP ID** section, under the **Global** tab, reporting that the AD9267 is interfaced (see Figure 8).

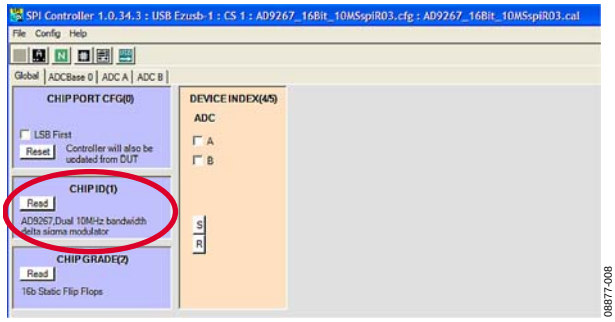


Figure 8. AD9267 SPIController

AD9516 SPI CONTROLLER

Double-click the SPIController icon to open another instance of the SPIController for control of the AD9516. If a box titled **Read Test Failure** appears, click **Ignore** to open the SPIController. This error occurs because the software has not been configured correctly to read from the chip. Use the following procedure to appropriately configure the SPIController to read and write to the AD9516:

1. From the **File** menu, select **CfgOpen**; then select **AD9516spiengR03.cfg**.
2. When a **Calibration File Error!** message appears, as shown in Figure 9, click **OK**.

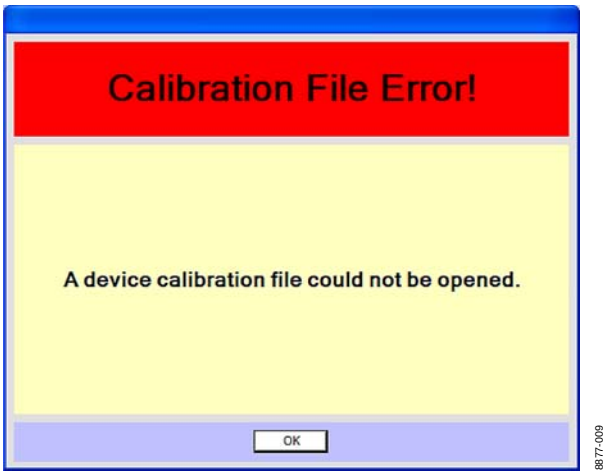


Figure 9. Calibration File Error

3. Select **Config** and then **Controller Dialog**. In the **AD9516 SPI Controller Cfg Dialog** window, make sure that **FIFO Chip Sel** is set to **2** and that **USB Chan #** is set to the same value as in the AD9267 SPIController (see Figure 10).

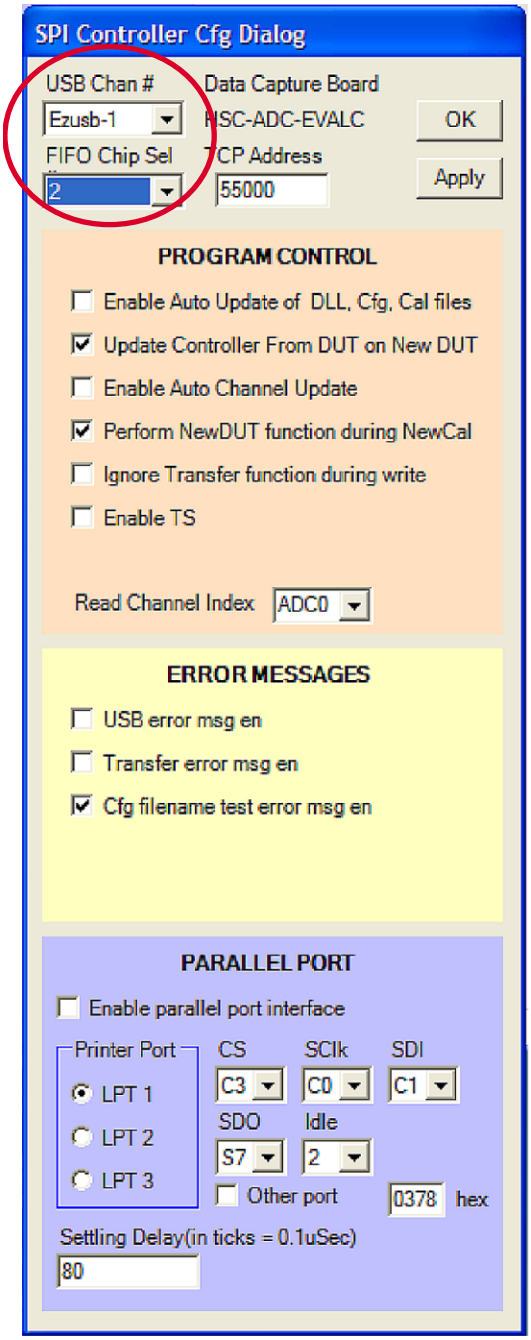


Figure 10. AD9516 SPIController

AD9516 REGISTER SETTINGS

The SPIController uses a 4-wire interface; therefore, the AD9516 must be configured for this interface before any further writes can take effect. To configure the AD9516, select the **SDO Enable** box, as shown in Figure 11.

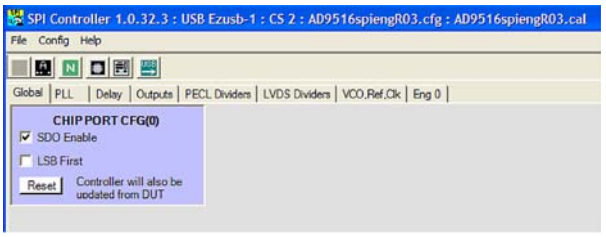


Figure 11. AD9516 Configuration

The AD9516 register settings depend on the particular clock option chosen. Table 8 provides a list of register settings for some common crystal oscillators. The configuration sequence (1 to 9) shown in Figure 12 and Figure 13 are for the 122.88 MHz crystal oscillator.

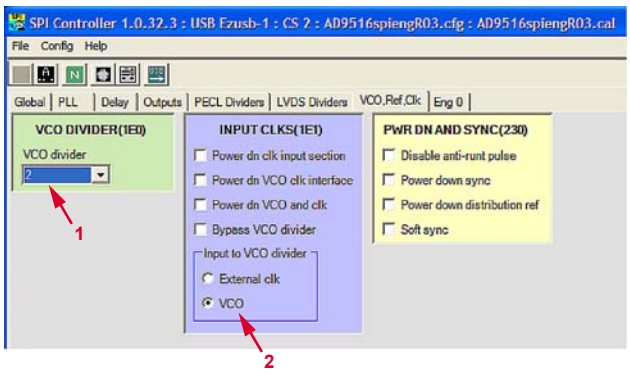


Figure 12. VCO and Clock Configuration for the 122.88 MHz Crystal Oscillator

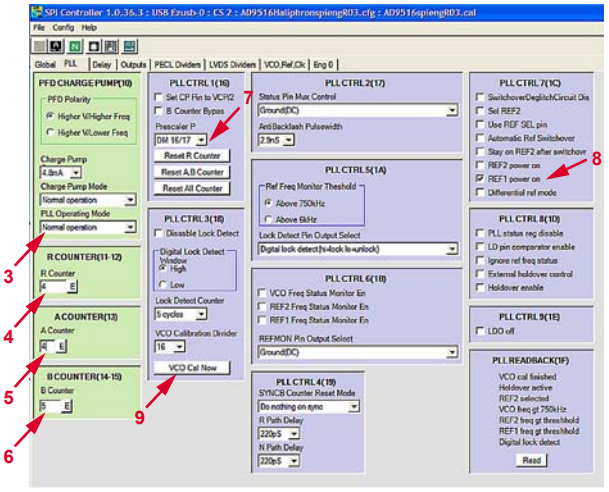


Figure 13. PLL Configuration for the 122.88 MHz Crystal Oscillator

Table 8. AD9516 Register Settings

Register	134.4 MHz	122.88MHz	39.3216MHz
VCO	2.688 GHz	2.580 GHz	2.595 GHz
R Divider	4	4	1
A/B Counter	0/5	4/5	2/4
Prescaler	16/17	16/17	16/17
Output CLK	672 MHz	645.12 MHz	648.81 MHz

VisualAnalog OVERVIEW

Open VisualAnalog and choose a template from the AD9267 folder (see Figure 14).

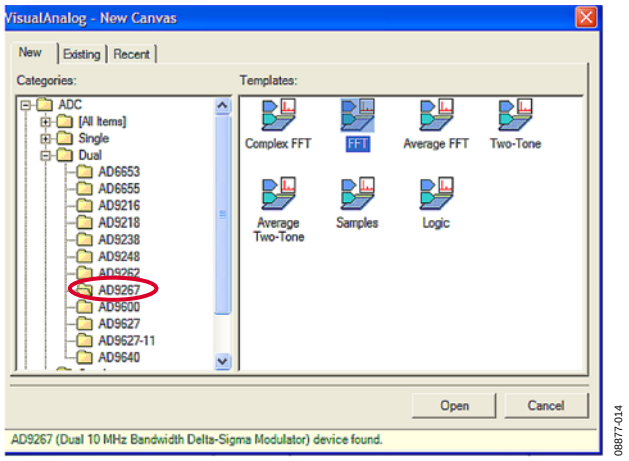


Figure 14. VisualAnalog Template

LOADING BINARY FILES INTO THE FPGA

Two binary files are available for the AD9267 on the evaluation package CD. The default file, **AD9267.bin**, allows the FPGA to capture data directly from the modulator at 640 MSPS; the second file, **AD9267_filter.bin**, incorporates decimation filters from the FPGA.

At the startup of VisualAnalog, you are prompted to load the default binary file into the FPGA. To load a different binary file, make sure the switches on U4 on the HSC-ADC-EVALCZ high speed ADC data capture card are configured to M0 = on, M1 = off, and M2 = off. In addition, configure the **ADC Data Capture** block on the VisualAnalog software by first clicking the icon as shown in Figure 15.

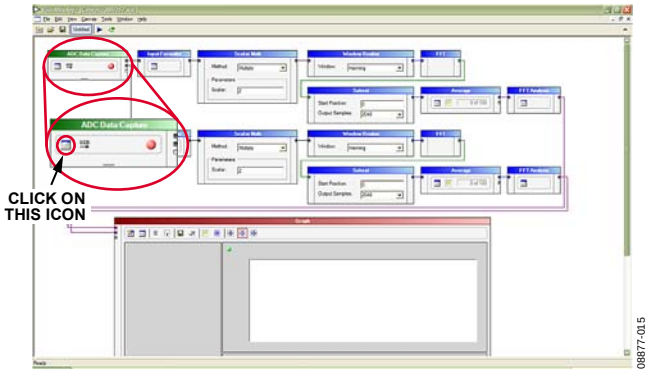


Figure 15. VisualAnalog ADC Data Capture Block

A new window opens (see Figure 16).

1. Click the **Browse** button to locate the desired bin file and then click **Program**.
2. After the file is loaded, click **OK**.



Figure 16. Loading the .bin File

After the binary file is loaded, make the following changes:

1. Select the **DCO Invert** box in the SPIController software of the AD9267 (see Figure 17).
2. Choose one of the following VisualAnalog templates to process the data:
   - **AD9267_Filter_FFT.vac**
   - **AD9267_Filter_ComplexFFT.vac**

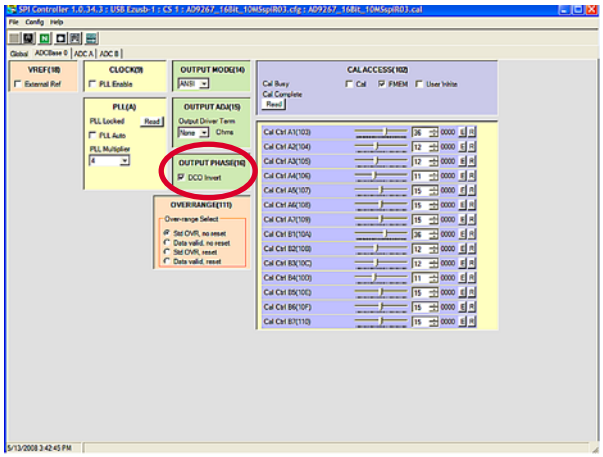


Figure 17. DCO Invert

SCHEMATICS

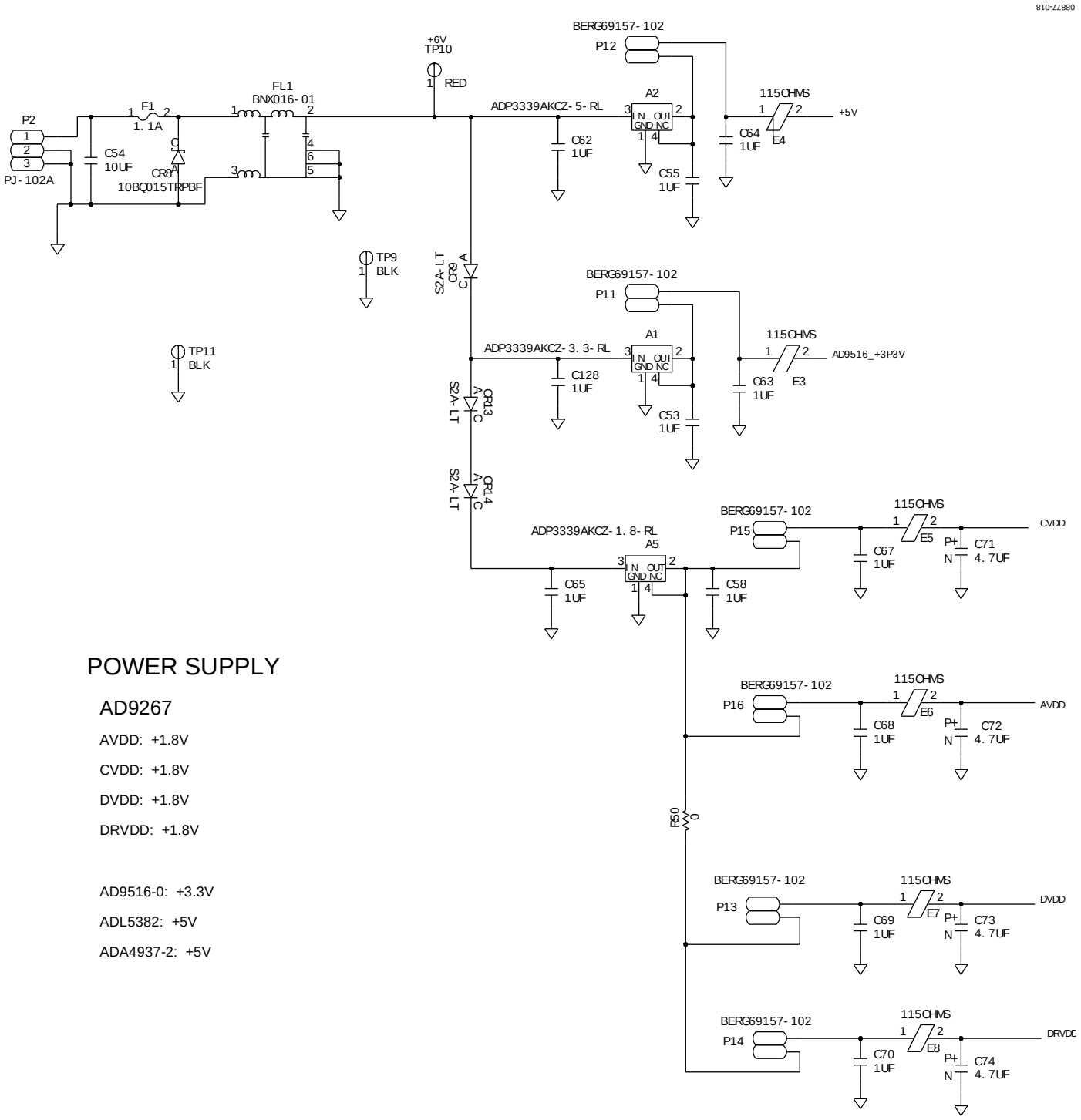


Figure 18. Power Supply Distribution

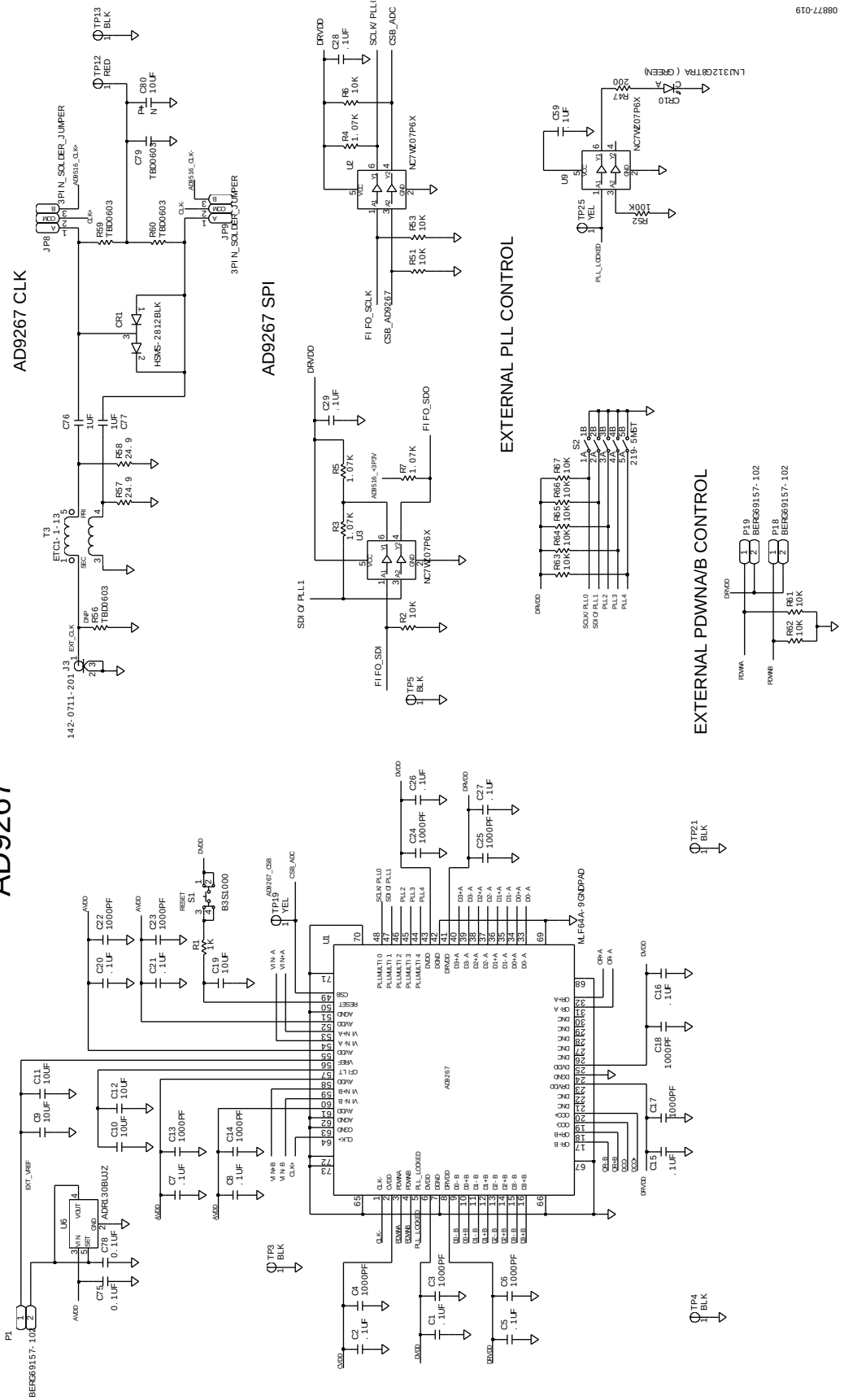


Figure 19. AD9267 Pinout

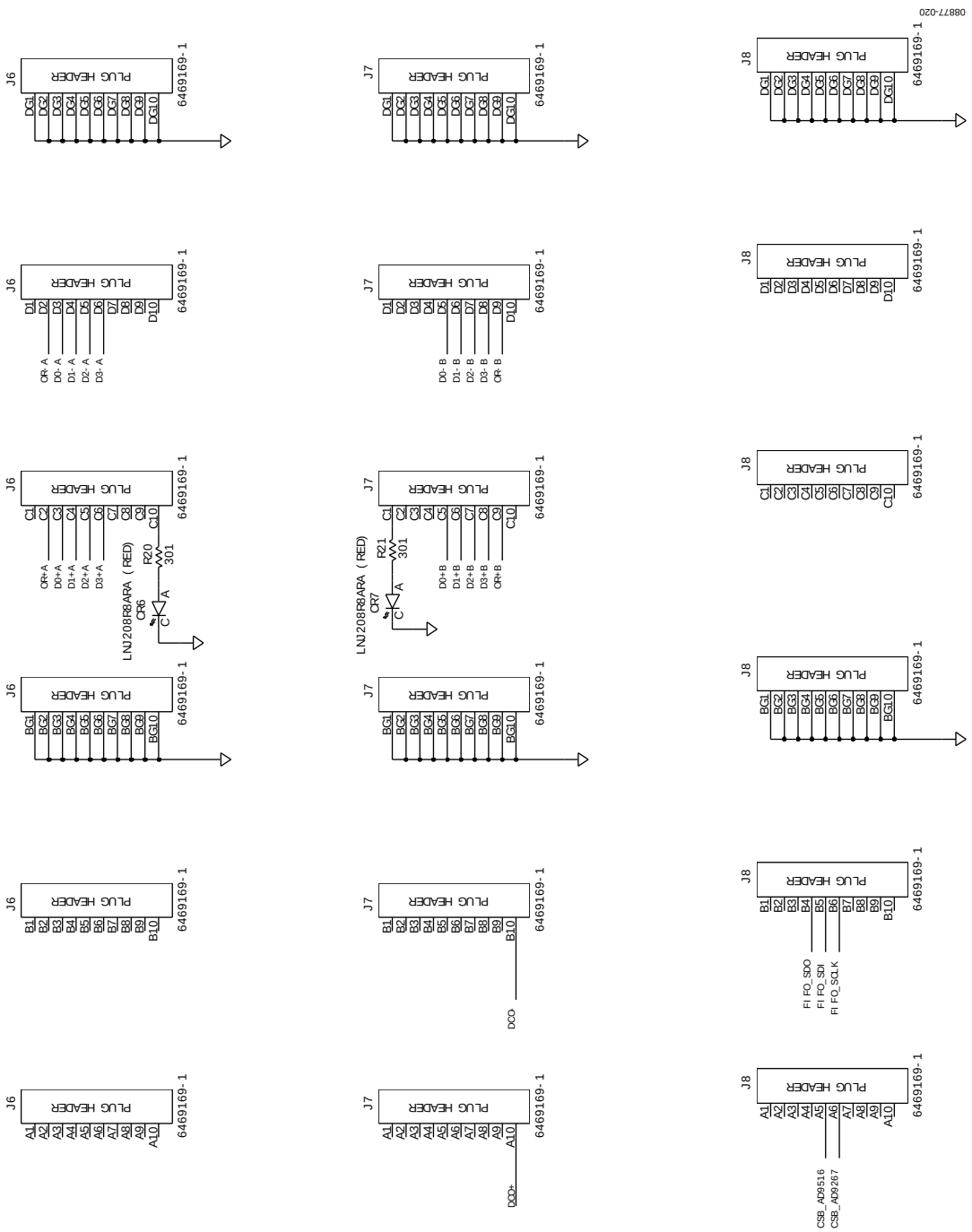


Figure 20. Data Interface to the HSC-ADC-EVALCZ High Speed ADC Data Capture Card

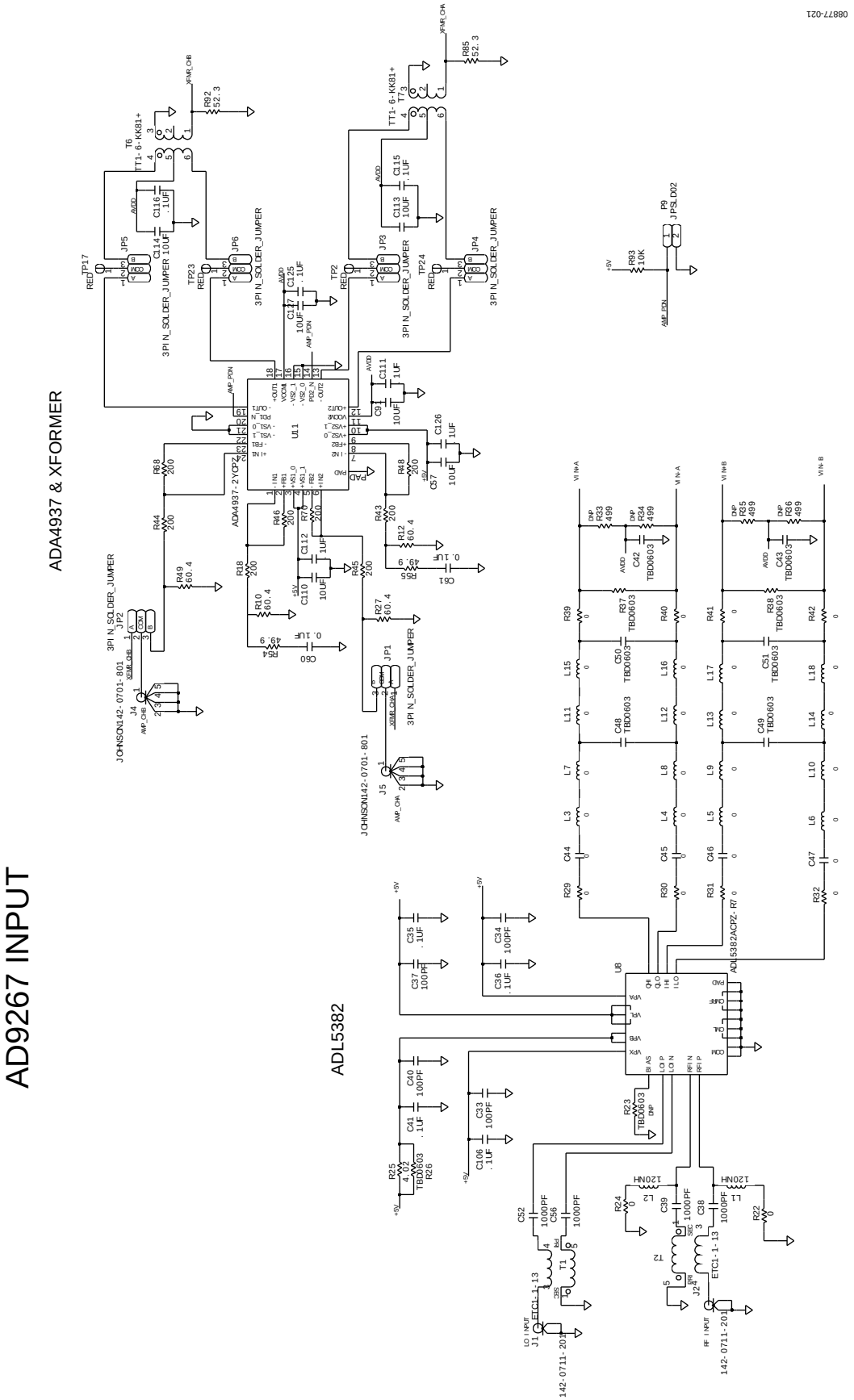


Figure 21. AD9267 Input Configuration

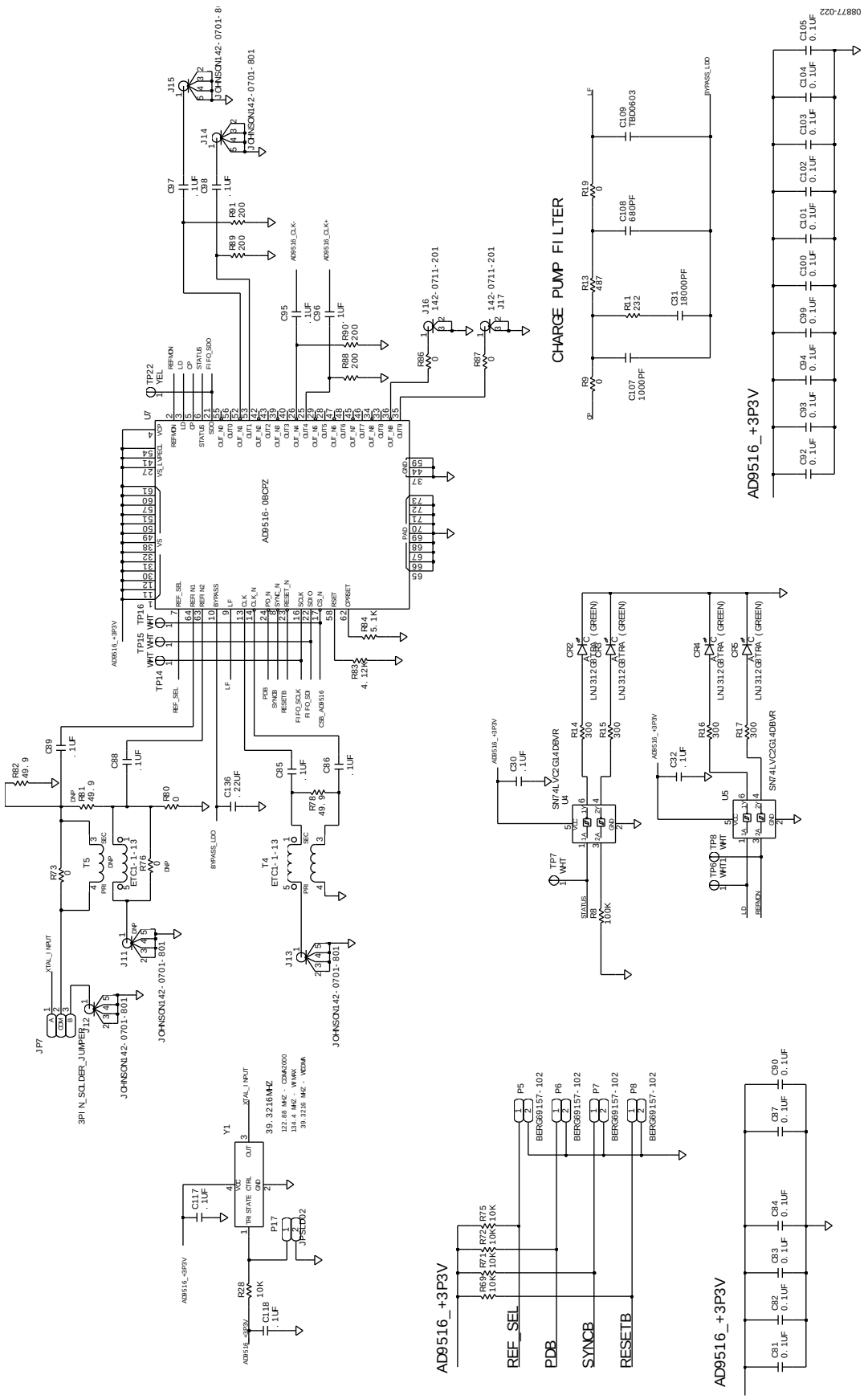


Figure 22. AD9516-0 Configuration

LAYOUT

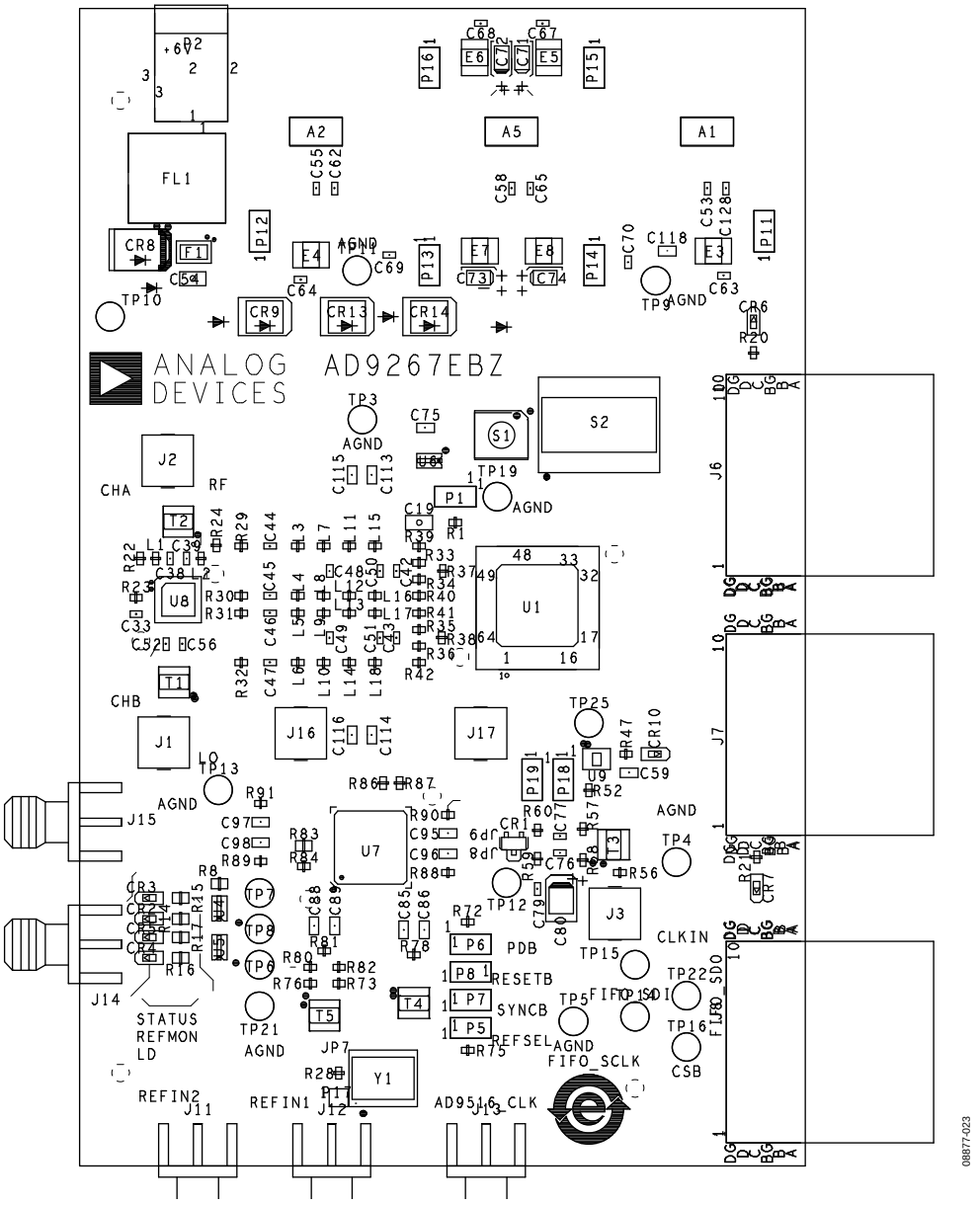


Figure 23. Top Silk

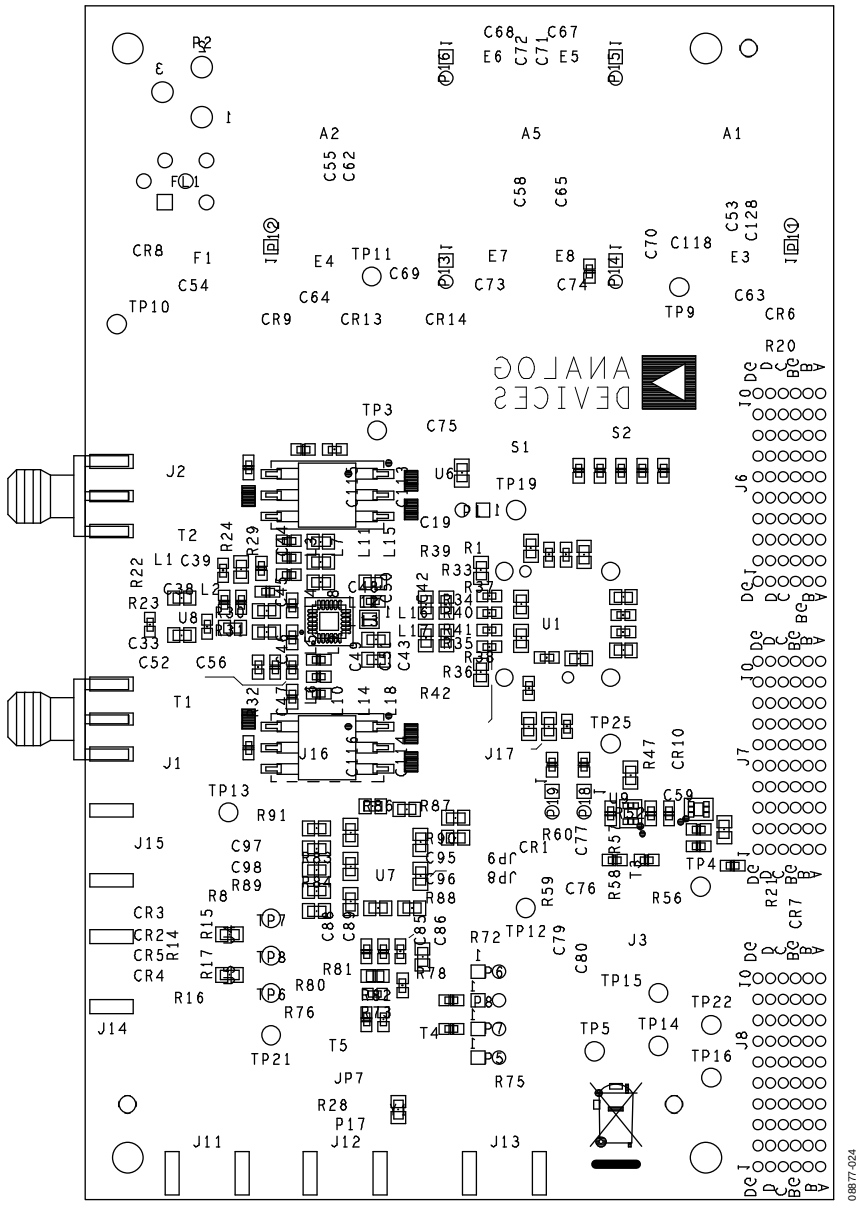


Figure 24. Bottom Silk

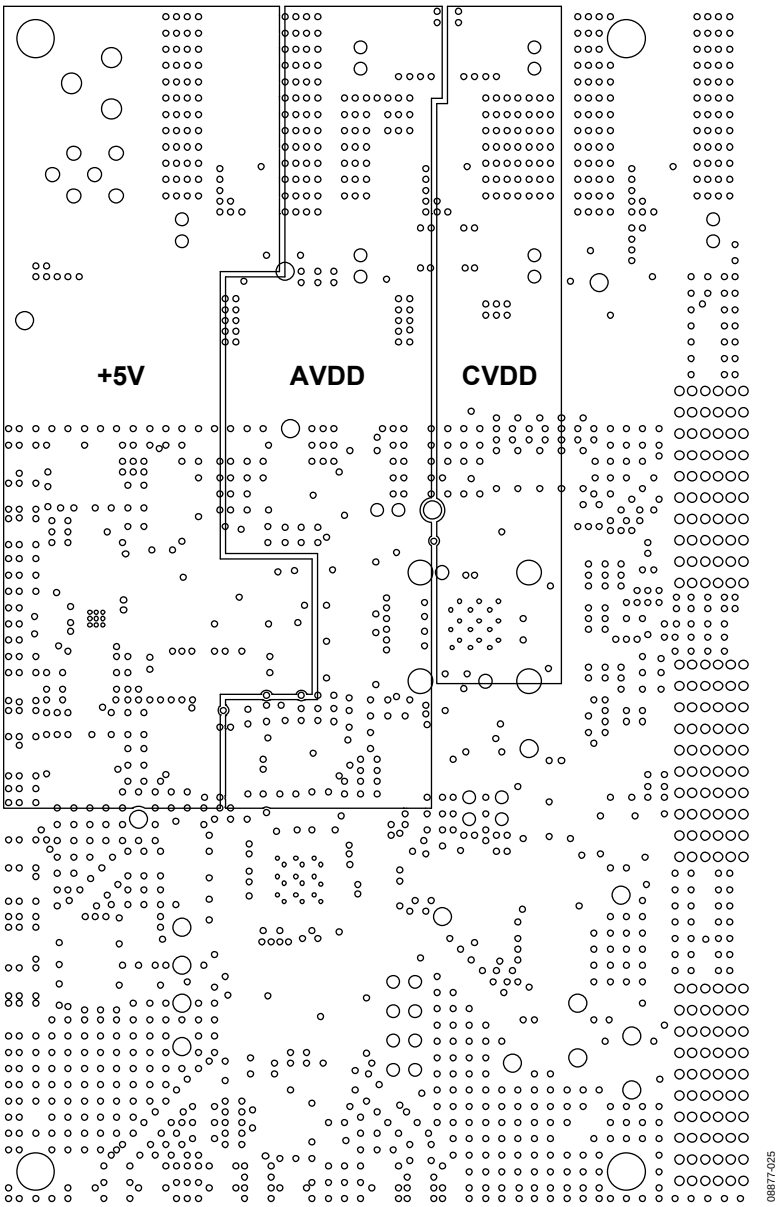


Figure 25. Power Layer 3

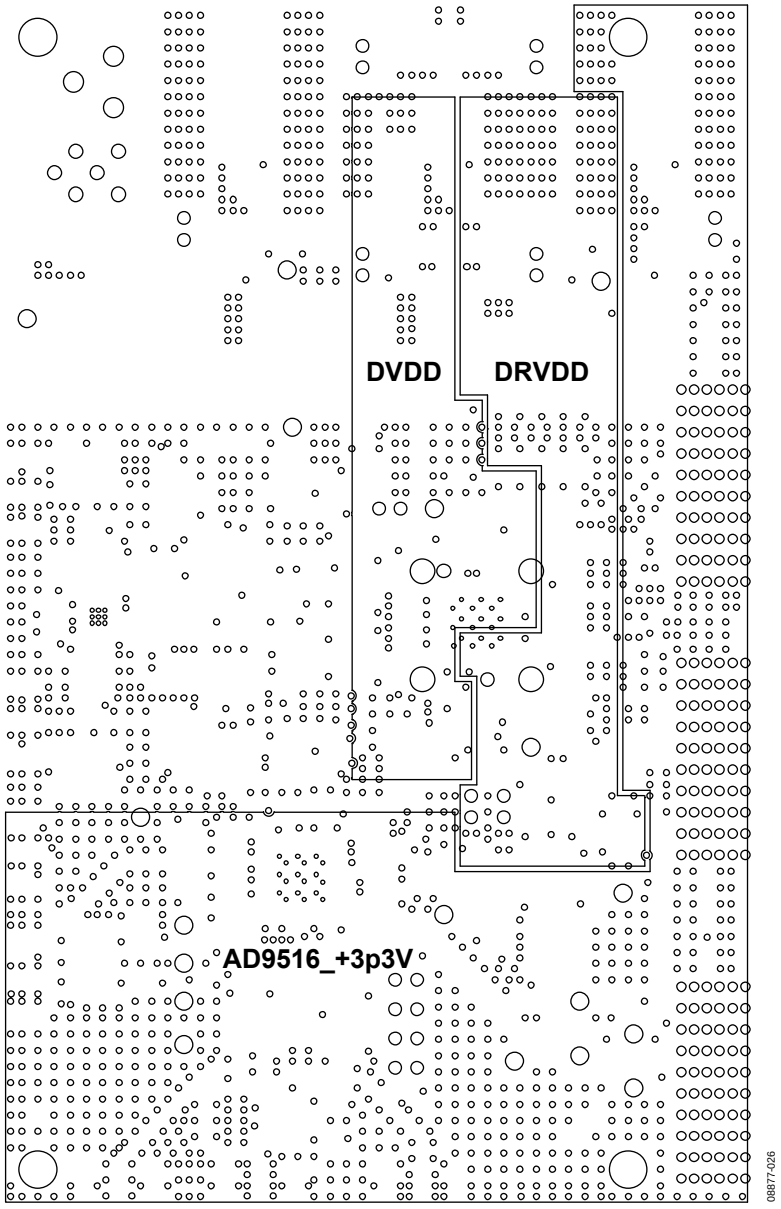


Figure 26. Power Layer 4

ORDERING INFORMATION

BILL OF MATERIALS

Table 9.

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part No.	Distributor/Part No.
1	A1	IC, high accuracy ADP3339A	Analog Devices	ADP3339AKCZ-3.3	
1	A2	IC, high accuracy ADP3339A	Analog Devices	ADP3339AKCZ-5	
1	A5	IC, high accuracy ADP3339A	Analog Devices	ADP3339AKCZ-1.8	
36	C1, C2, C5, C7, C8, C15, C16, C20, C21, C26, C27, C28, C29, C30, C32, C35, C36, C41, C59, C85, C86, C88, C89, C95, C96, C97, C98, C106, C111, C112, C115, C116, C117, C118, C125, C126	Capacitor, ceramic, 0.10 µF, 16 V, 10%, X7R, 0805	Murata Electronics, North America	GRM219R71C104KA01D	Digi-Key 490-1683-1-ND
4	C9, C10, C11, C12	Capacitor, 10 µF, 6.3 V, ceramic, X5R, 0805	Panasonic-ECG	ECJ-2FB0J106M	Digi-Key PCC2225CT-ND
18	C75, C78, C81, C82, C83, C84, C87, C90, C92 C93, C94, C99, C100, C101, C102, C103, C104, C105	Capacitor, 0.10 µF, 50 V, ceramic, X7R, 0805	Panasonic-ECG	ECJ-2YB1H104K	Digi-Key PCC1840CT-ND
1	C107	Capacitor, ceramic, 1000 pF, 50 V, NP0, 0603	Panasonic-ECG	ECJ-1VC1H102J	Digi-Key PCC2151CT-ND
1	C108	Capacitor, 680 pF, 50 V, ceramic, X7R, 0603	Yageo, Panasonic-ECG	CC0603KRX7R9, BB681, ECU-V1H681KBV	Digi-Key 311-1188-1-ND, Digi-Key PCC681BVCT-ND
4	C44, C45, C46, C47	Resistor, 0.0 Ω, 1/10 W, 5%, 0603, SMD	ROHM Semiconductor	MCR03EZPJ000	Digi-Key RHM0.0GDKR-ND
0	C42, C43, C48, C49, C50, C51, C79, C109	0603, not populated			
6	C57, C91, C110, C113, C114, C127	Capacitor, ceramic, 10 µF, 10 V, 10%, X5R, 0805	Murata Electronics, North America	GRM21BR61A106KE	Digi-Key 490-1709-1-ND
14	C53, C55, C58, C62, C63, C64, C65, C67, C68, C69, C70, C76, C77, C128	Capacitor, 1 µF, 6.3 V, ceramic, X5R, 0603	Panasonic-ECG	ECJ-1VB0J105K	Digi-Key PCC1915CT-ND
15	C3, C4, C6, C13, C14, C17, C18, C22, C23, C24, C25, C38, C39, C52, C56	Capacitor, 1000 pF, 50 V, ceramic, X7R, 0603; Capacitor, 1000 pF, 50 V, ceramic, 0603, SMD	Panasonic-ECG	ECJ-1VB1H102K, ECU-V1H102KBV	Digi-Key PCC1772CT-ND, Digi-Key PCC102BVCT-ND
1	C136	Capacitor, 0.22 µF, 25 V, ceramic, X7R, 0805	Panasonic-ECG	ECJ-2YB1E224K	Digi-Key PCC1832CT-ND
2	C19, C54	Capacitor, 10 µF, 16 V, ceramic, X5R, 1206	Panasonic-ECG	ECJ-3YB1C106M	Digi-Key PCC2227CT-ND
1	C31	Capacitor, 18,000 pF, 25 V, ceramic, X7R, 0603	Panasonic-ECG	ECJ-1VB1E183K	Digi-Key PCC1766CT-ND
4	C33, C34, C37, C40	Capacitor, ceramic, 100 pF, 50 V, 0603, SMD	Panasonic-ECG	ECU-V1H101JCV	Digi-Key PCC101ACVCT-ND
2	C60, C61	Capacitor, 0.10 µF, 50 V, ceramic, Y5V, 0603	Panasonic-ECG	ECJ-1VF1H104Z	Digi-Key PCC2153CT-ND

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part No.	Distributor/Part No.
4	C71, C72, C73, C74	Capacitor, tantalum, 4.7 µF, 16 V, 20%, SMD, A-case; Capacitor, 4.7 µF, 16 V, tantalum TE series, 3216-18	AVX Corporation, Panasonic-ECG	TAJA475M016R, ECS-T1CY475R	Digi-Key 478-3032-1-ND, Digi-Key PCS3475CT-ND
1	C80	Capacitor, tantalum, 10 µF, 16 V, 10%, SMD, B-case 3528	AVX Corporation	TAJB106K016R	Digi-Key 478-1673-1-ND
1	CR1	Schottky diode	Avago Technologies	HSMS-2812-BLKG	Mouser 630-HSMS-2812-BLKG
5	CR2, CR3, CR4, CR5, CR10	LED, green, TSS type SMD, 0603	Panasonic-SSG	LNJ312G8TRA	Digi-Key P11134CT-ND
3	CR9, CR13, CR14	Rectifier, SIL, 2 A, 50 V, DO-214AA	Micro Commercial Company	S2A-TP	Digi-Key S2A-TPMSCT-ND
2	CR6, CR7	LED red HI BRT SS type LO CUR surface mount, 0603	Panasonic-SSG	LNJ208R8ARA	Digi-Key P524CT-ND
1	CR8	Diode Schottky, 15 V, 1 A SMB, DO-214AA	Vishay IR	10BQ015TRPBF	Digi-Key 10BQ015PBFCT-ND
6	E3, E4, E5, E6, E7, E8	Bead core, 4.5 × 3.2 × 1.8 SMD	Panasonic-ECG	EXC-CL4532U1	Digi-Key P9812CT-ND
1	F1	Polyswitch, 1.10 A, reset fuse SMD	Tyco Electronics Raychem Circuit Protection	NANOSMDC110F-2	Digi-Key NANOSMDC110FCT-ND
1	FL1	Filter EMI, 50 MΩ, 15 A, 0.10 MHz, 1 GHz, SMD	Murata Electronics, North America	BNX016-01	Mouser 81-BNX016-01
5	J1, J2, J3, J16, J17	Connector SMA jack receptacle VERT gold SMD, SMAUPSMD	Emerson Network Power Connectivity Solutions	142-0711-201	Mouser 530-142-0711-201 Digi-Key J819-ND
6	J4, J5, J12, J13, J14, J15	Connector jack end launch PCB 0.187" G	Emerson Network Power Connectivity Solutions	142-0701-801	Mouser 530-142-0701-801 Digi-Key J502-ND
3	J6, J7, J8	Plug header	Tyco Electronics	6469169-1	Mouser 571-6469169-1
0	J11	Connector jack end launch PCB 0.187" G, not populated	Emerson Network Power Connectivity Solutions	142-0701-801	Mouser 530-142-0701-801 Digi-Key J502-ND
2	L1, L2	Inductor, 120 nH, 5%, fixed, 0603, SMD	Panasonic-ECG	ELJ-RER12JFA	Digi-Key PCD1986CT-ND
16	L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16, L17, L18	Resistors, 0.0 Ω, 1/10 W, 5%, 0603, SMD	ROHM Semiconductor	MCR03EZPJ000	Digi-Key RHM0.0GDKR-ND
13	P1, P5, P6, P7, P8, P11, P12, P13, P14, P15, P16, P18, P19	Connector header 2 POS 0.100 VERT gold	Molex/Waldom Electronics Corporation, BERG	22-10-2021 69157-102	Digi-Key WM2722-ND
6	P11, P12, P13, P14, P15, P16	Shunt, ECON, PHBR 15 AU, black	Tyco Electronics	382811-6	Digi-Key A26227-ND
1	P2	Connector jack power, 2.1 mm PCB	CUI, Inc.	PJ-102A	Digi-Key CP-102A-ND
1	R1	Resistor, 1.00 kΩ, 1/10 W, 1%, 0603, SMD	ROHM Semiconductor, Panasonic-ECG	MCR03EZPFX1001, ERJ-3EKF1001V	Digi-Key RHM1.00KHCT-ND, Digi-Key P1.00KHCT-ND
4	R10, R12, R27, R49	Resistor, 60.4 kΩ, 1/10 W, 1%, 0603, SMD	Panasonic-ECG	ERJ-3EKF60R4V	Digi-Key P60.4HCT-ND
1	R11	Resistor, 232 Ω, 1/10 W, 1%, 0603, SMD	Panasonic-ECG	ERJ-3EKF2320V	Digi-Key P232HCT-ND

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part No.	Distributor/Part No.
1	R13	Resistor, 487 Ω, 1/8 W, 1%, 0805, SMD	Panasonic-ECG	ERJ-6ENF4870V	Digi-Key P487CCT-ND
4	R14, R15, R16, R17	Resistor, 300 Ω, 1/8 W, 5%, 0805, SMD	Panasonic-ECG	ERJ-6GEYJ301	Digi-Key P300ACT-ND
13	R18, R43, R44, R45, R46, R47, R48, R68, R70, R88, R89, R90, R91	Resistor, 200 Ω, 1/10 W, 1%, 0603, SMD	Yageo	RC0603FR-07200RL	Digi-Key 311-200HRCT-ND
9	R9, R19, R22, R24, R50, R73, R80, R86, R87	Resistor, 0 Ω, 1/10 W, 5%, 0603, SMD	Panasonic-ECG	ERJ-3GEY0R00V	Digi-Key P0.0GCT-ND
0	R76	0603, not populated	Panasonic-ECG	ERJ-3GEY0R00V	Digi-Key P0.0GCT-ND
16	R2, R6, R28, R51, R53, R61, R62, R63, R64, R65, R66, R67, R69, R71, R72, R75	Resistor, 10.0 kΩ, 1/10 W, 1%, 0603, SMD	ROHM Semiconductor, Panasonic-ECG	MCR03EZPFX1002, ERJ-3EKF1002V	Digi-Key RHM10.0KHCT-ND, Digi-Key P10.0KHCT-ND
2	R20, R21	Resistor, 301 Ω, 1/10 W, 1%, 0603, SMD	Panasonic-ECG	ERJ-3EKF3010V	Digi-Key P301HCT-ND
8	R29, R30, R31, R32, R39, R40, R41, R42	Resistor, 0.0 Ω, 1/10 W, 5%, 0603, SMD	ROHM Semiconductor	MCR03EZPJ000	Digi-Key RHM0.0GDKR- ND
0	R23, R26, R37, R38, R56, R59, R60	0603, not populated			
1	R25	Resistor, 4.02 Ω, 1/10 W, 1%, 0603, SMD	Yageo	RC0603FR-074R02L	Digi-Key 311-4.02HRCT-ND
4	R3, R4, R5, R7	Resistor, 1.07 kΩ, 1/16 W, 0.10%, 0603, SMD	Susumu Company, Ltd.	RR0816P-1071-B-T5-04H	Digi-Key RR08P1.07KBCT-ND
0	R33, R34, R35, R36	0603, not populated	Panasonic-ECG	ERJ-3EKF4990V	Digi-Key P499HCT-ND
1	R52	Resistor, 100 kΩ, 1/10 W, 5%, 0603, SMD	Yageo	RC0603JR-07100KL	Digi-Key 311-100KGRCT-ND
4	R54, R55, R78, R82	Resistor, 49.9 Ω, 1/10 W, 1%, 0603, SMD	Yageo, Panasonic-ECG	RC0603FR-0749R9L, ERJ-3EKF49R9V	Digi-Key 311-49.9HRCT-ND, Digi-Key P49.9HCT-ND
0	R81	0603, not populated	Yageo, Panasonic-ECG	RC0603FR-0749R9L, ERJ-3EKF49R9V	Digi-Key 311-49.9HRCT-ND, Digi-Key P49.9HCT-ND
2	R57, R58	Resistor, 24.9 Ω, 1/10 W, 1%, 0603, SMD	Yageo, Panasonic-ECG	RC0603FR-0724R9L, ERJ-3EKF24R9V	Digi-Key 311-24.9HRCT-ND Digi-Key ND P24.9HCT-ND
1	R8	Resistor, 100 kΩ, 1/8 W, 0.10%, 0805, SMD	Panasonic-ECG	ERA-6YEB104V	Digi-Key P100KZCT-ND
1	R83	Resistor, 4.12 kΩ, 1/8 W, 1%, 0805, SMD	Panasonic-ECG	ERJ-6ENF4121V	Digi-Key P4.12KCCT-ND
1	R84	Resistor, 5.1 kΩ, 1/16 W, 0.1%, 0603, SMD	Panasonic-ECG	ERA-3YEB512V	Digi-Key P5.1KYCT-ND
2	R85, R92	Resistor, 52.3 Ω, 1/10 W, 1%, 0603, SMD	Panasonic-ECG	ERJ-3EKF52R3V	Digi-Key P52.3HCT-ND
1	R93	Resistor, 10 kΩ, 1/10 W, 0.10%, 0603, SMD	Panasonic-ECG	ERA-3YEB103V	Digi-Key P10KYCT-ND
1	S1	Switch, TACT, 6 mm, SMD, MOM, 160GF	Omron Electronics Inc., ECB Division	B3S-1000	Digi-Key SW415-ND
1	S2	Switch, tape seal, 5-position SMD	CTS Corporation Resistor/ Electrocomponents	219-5MST	Digi-Key CT2195MST-ND
4	T1, T2, T3, T4	TC XFMR/surface-mount	Minicircuits	TC1-1-13M+	
0	T5	Not populated	Minicircuits	TC1-1-13M+	
2	T6, T7	RF XFMR/surface-mount	Minicircuits	TT1-6-KK81+	

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part No.	Distributor/Part No.
2	TP10, TP12	Test point PC compact 0.063" D, red	Keystone Electronics	5005 TP-104-01-02	Digi-Key 5005K-ND
7	TP3, TP4, TP5, TP9, TP11, TP13, TP21	Test point, PC, compact 0.063" D, black	Keystone Electronics	5006 TP-104-01-00	Digi-Key 5006K-ND
6	TP6, TP7, TP8, TP14, TP15, TP16	Test point, PC, compact 0.063" D, white	Keystone Electronics	5007 TP-104-01-09	Digi-Key 5007K-ND
4	TP2, TP17, TP23, TP24	PC test point miniature SMT, red	Keystone Electronics	5015 TP-108-01	Digi-Key 5015KCT-ND
3	TP19, TP22, TP25	Test point PC compact 0.063" D, yellow	Keystone Electronics Components Corporation	5009 TP-104-01-04	Digi-Key 5009K-ND
1	U1	Device under test	Analog Devices	AD9267	
1	U11	IC, ultralow distortion DIF ADC driver	Analog Devices	ADA4937-2YCPZ	
3	U2, U3, U9	IC buffer dual open-drain output, 6-lead SC70	Fairchild Semiconductor	NC7WZ07P6X	Mouser 512-NC7WZ 07P6X Digi-Key NC7WZ07P6XCT-ND
2	U4, U5	IC inverter, dual SHMT-T, SOT-23-6	Texas Instruments	SN74LVC2G14DBVR	Digi-Key 296-13010-1-ND Mouser 595-SN74LVC2G 14DBVR
1	U6	Precision series, ADR130BU	Analog Devices	ADR130BUJZ	
1	U7	IC, 14-output, AD9516-0	Analog Devices	AD9516-0BCPZ	
1	U8	IC, 700 MHz to 2700 MHz quadrature	Analog Devices	ADL5382ACPZ	
0	Y1	IC clock OSC, not populated	Valpey Fisher	VFAC3	

RELATED LINKS

Resource	Description
AD9267	AD9267 data sheet (for technical articles, visit the AD9267 product page technical documentation section)
AD9262	AD9262 data sheet (for technical articles, visit the AD9262 product page technical documentation section)
CN0062	Circuit Note, Interfacing the ADL5382 Quadrature I/Q Demodulator to the AD9262 16-Bit Continuous Time Sigma-Delta ADC as an RF-to-Bits Solution
HSC-ADC-EVALCZ	Product Page, High Speed Converter Evaluation Platform (FPGA-based data capture kit)
AN-905	Application Note, VisualAnalog Converter Evaluation Tool Version 1.0 User Manual
AN-878	Application Note, High Speed ADC SPI Control Software
AN-877	Application Note, Interface to High Speed ADCs via SPI

NOTES



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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