Evaluating the AD9834 20 mW Power, 2.3 V to 5.5 V, 75 MHz Complete DDS by Using the EVAL-CN0304-SDZ

FEATURES

- Full featured evaluation board (EVAL-CN0304-SDZ) for the AD9834
- Graphic user interface software for board control and data analysis
- Connector to the EVAL-SDP-CB1Z System Demonstration Platform (SDP) board
- Various power supply and reference link options

APPLICATIONS

- Biomedical sensors
- Bioelectrical impedance analysis
- Electrochemical analysis
- Impedance spectroscopy
- Complex impedance measurement
- Nondestructive testing

GENERAL DESCRIPTION

The AD9834 is a 75 MHz, low power DDS device capable of producing high performance sine and triangular outputs. It also has an on-board comparator that allows a square wave to be produced for clock generation. Consuming only 20 mW of power at 3 V makes the AD9834 an ideal candidate for power-sensitive applications.

The EVAL-CN0304-SDZ board is used in conjunction with a EVAL-SDP-CB1Z board available from Analog Devices, Inc. The USB to SPI communication to the AD9834 is completed using this Blackfin®-based development board.

A high performance, on-board 75 MHz trimmed general oscillator is available to use as the master clock for the AD9834 system. Various links and SMB connectors are also available on the EVAL-CN0304-SDZ board to maximize the usability.

Complete specifications for the AD9834 are provided in the AD9834 data sheet, available from Analog Devices. Consult the AD9834 data sheet in conjunction with this user guide when using the evaluation board.

FUNCTIONAL BLOCK DIAGRAM

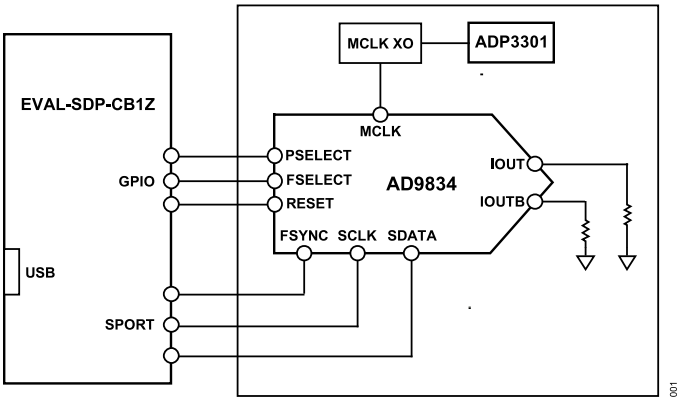

Figure 1. AD9834 Evaluation Board Block Diagram

TABLE OF CONTENTS

REVISION HISTORY

3/2023—Rev. B to Rev. C

Changed EVAL-CN-304-SDZ to EVAL-CN0304-SDZ (Throughout).... 1
Changes to Figure 1 Caption.... 1
Changes to Figure 2.... 3
Changes to Table 2.... 11

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-CN0304-SDZ evaluation kit includes the software and drivers on a CD. The software is compatible with Windows® XP, Windows Vista, Windows 7, and Windows 10.

To install the software, follow these steps:

1. Install the software before connecting the EVAL-SDP-CB1Z board to the USB port of the PC.
2. Start the Windows operating system and install the software from the EVAL-CN0304-SDZ evaluation kit CD or if you do not have a CD drive, download it from the **Software** section of the EVAL-CN0304 page.
3. After installation of the software and drivers is complete, plug the EVAL-CN0304-SDZ into the EVAL-SDP-CB1Z board, and then plug the EVAL-SDP-CB1Z board into the PC using the USB cable included in the box.
4. When the software detects the evaluation board, you can start using it. Check that the computer recognizes the development board through the **Device Manager**, as shown in Figure 2.

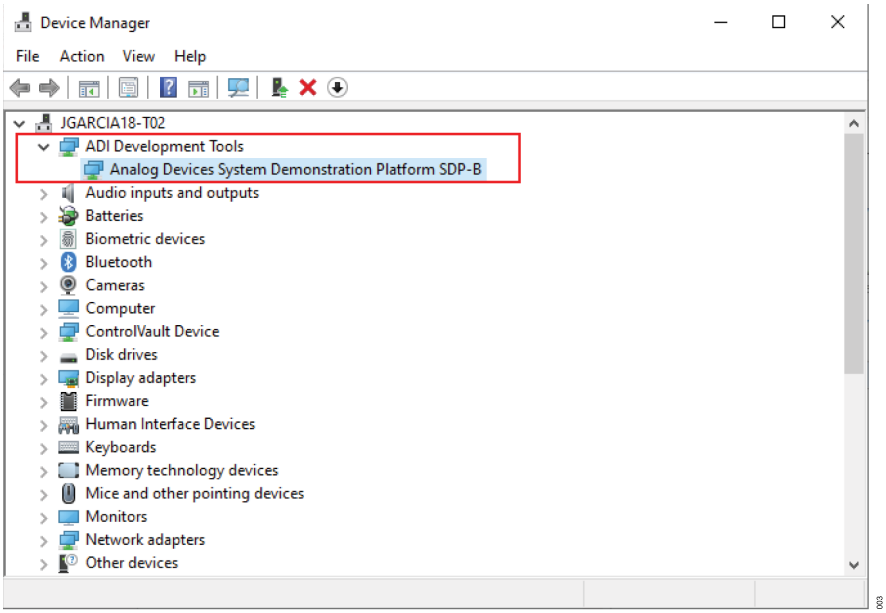

Figure 2. Hardware Device Manager Window with the EVAL-SDP-CB1Z Board Plugged In

EVALUATION BOARD SOFTWARE

RUNNING THE SOFTWARE

To run the evaluation board program, do the following:

1. Click **Start/All Programs/Analog Devices/AD9834/AD9834 Eval Board**.
2. If the EVAL-SDP-CB1Z board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 3). Simply connect the EVAL-CN0304-SDZ evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.
3. Ensure that all links are in their correct locations (see Table 1). The main window of the EVAL-CN0304-SDZ evaluation software then opens, as shown in Figure 4.

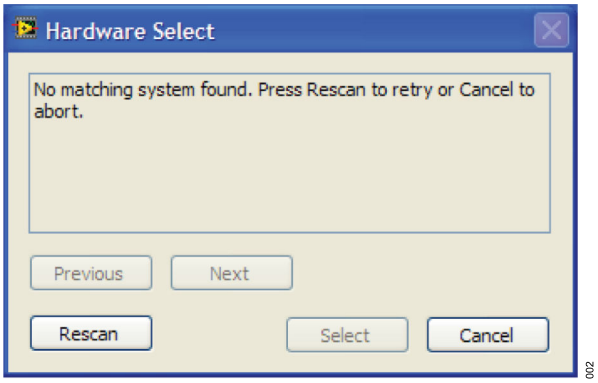

Figure 3. Pop-Up Window Error

Table 1. Default Setup for Link Positions

Link No.	Position	Function
LK1	A	External DVDD supply powers the on-board oscillator
	B (default)	On-board linear regulator selected to supply power to the general oscillator
LK2	A	Digital block powered through the DVDD external connector
	B (default)	3.3 V digital supply for the AD9834 supplied by the EVAL-SDP-CB1Z board
LK3	Out (default)	Decouple the CAP/2.5V pin to ground because V_{DD} is >2.7 V
	In	Connect the jumper when the external DVDD supply < 2.7 V
LK4	A	Analog supply provided by the external AVDD connector
	B (default)	3.3 V analog supply for the AD9834 supplied by the EVAL-SDP-CB1Z board

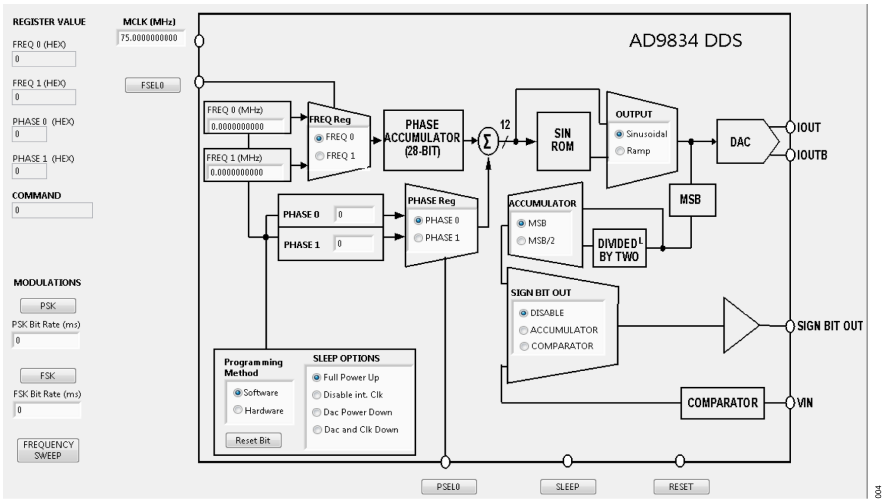

Figure 4. EVAL-CN0304-SDZ Evaluation Board Software

EVALUATION BOARD SOFTWARE

OPERATING THE SOFTWARE

Select External MCLK Frequency

Having selected the digital interface specifics, next use the **MCLK** box to choose which frequency to use. The boards are supplied with a 75 MHz general oscillator. If a different clock source is required, the CLK1 SMB connector can be used to supply a different MCLK value.

Two options for the general oscillator include the AEL3013 oscillators from AEL Crystals and the SG-310SCN oscillators from Epson Electronics.

Figure 5. MCLK Input

Programming Method: Hardware or Software

Functions that select frequency and phase registers, reset internal registers, and power down the DAC can be implemented by using either software or hardware. Click **Software** or **Hardware** to select the programming method (see Figure 6). By choosing hardware, the appropriate hardware control pins are used to control these functions. By choosing software, the appropriate software control bits are used to control these functions.

Figure 6. Programming Method

Loading Frequency and Phase Registers

The desired output frequency and output phase can be loaded using the inputs shown in Figure 7. Either the **FREQ 0** register or the **FREQ 1** register can be loaded with frequency data. The frequency data is loaded in megahertz, and the equivalent hexadecimal code is shown to the right once data is entered; press **Enter** to load the data. When data is loaded, the output appears on the IOUT and IOUTB pins. Similarly, select either the **PHASE 0** register or the **PHASE 1** register and the phase data loads in degrees.

The analog output frequency from the AD9834 is defined by

$$f_{MCLK}/2^{28} \times FREQREG \quad (1)$$

where *FREQREG* is the value loaded into the selected frequency register in decimals. This signal is phase shifted by

$$2\pi/4096 \times PHASEREG \quad (2)$$

where *PHASEREG* is the value contained in the selected phase register in decimals.

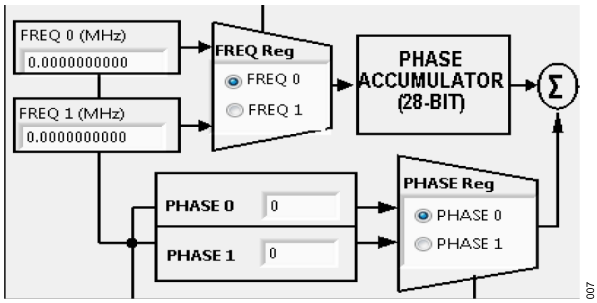

Figure 7. Frequency and Phase Load

FSK and PSK Functionality

In software mode, the AD9834 can be set up for FSK or PSK functionality by entering the bit rate in milliseconds and by clicking the **PSK** or **FSK** button (see Figure 8).

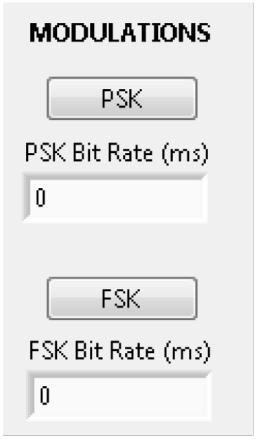

Figure 8. FSK and PSK Functionality

Waveform Options

The output waveform options that can be selected are sinusoidal waveform or ramp waveform. The SIGN BIT OUT pin output can be selected using three options: selecting **MSB** or **MSB/2** of the phase accumulator or selecting the internal comparator. If this pin is not used, click **DISABLE** (see Figure 9).

EVALUATION BOARD SOFTWARE

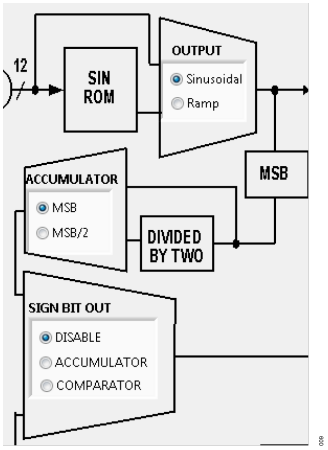

Figure 9. Waveform Profile and SIGN BIT OUT

Power-Down Options

The AD9834 has various power-down options selected through the control register. The master clock (MCLK) or the DAC can be disabled, or both sections can be powered down for a lower power sleep mode (see Figure 10).

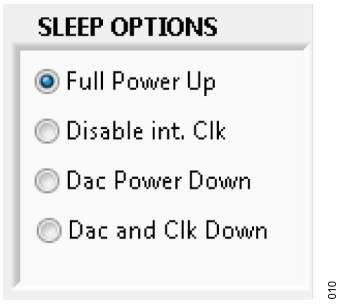

Figure 10. Power-Down Options

Hardware Options

If the hardware programming method is selected (see Figure 6), the FSELECT (**FSEL0**), PSELECT (**PSEL0**), **RESET**, and **SLEEP** pin functions can be toggled. The GPIO outputs on the EVAL-SDP-CB1Z board control these pin functions. For example, frequency data can be loaded to the FREQ 0 register and the FREQ 1 register and the output can be toggled by the FSELECT pin, that is, 2FSK functionality.

Figure 11. GPIO Hardware Pin Control

Figure 12. FSEL0 Hardware Pin Control

Reset and Sweep

Use the **Reset Bit** button shown in Figure 13 to set the reset software command. To set up a DDS sweep, click **FREQUENCY SWEEP**.

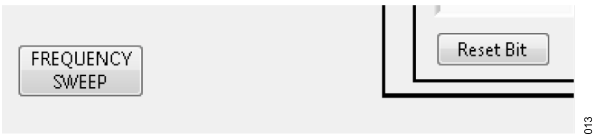

Figure 13. Software Reset and Sweep Select

The sweep function allows users to load a **Start Frequency**, **Stop Frequency**, increment size (**Step Frequency**), number **of loops** (**N. of Loops**), and **Delay** between each frequency increment. These commands then load to the device automatically from the EVAL-SDP-CB1Z board.

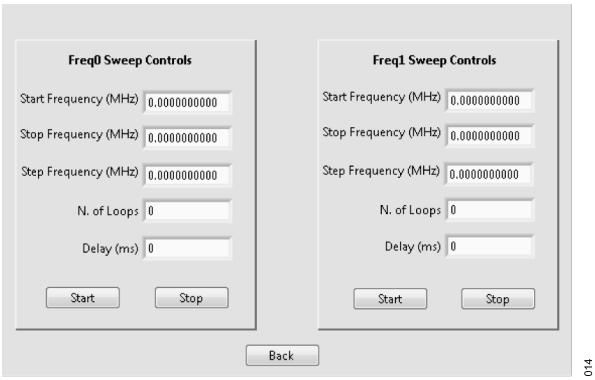

Figure 14. Sweep Functionality

Example of Operation

An example of configuring the AD9834 to output 1 MHz follows:

1. Plug the EVAL-SDP-CB1Z board into the EVAL-CN0304-SDZ board and connect to the USB port.
2. Start up the software located at **Start/All Programs/ Analog Devices/AD9834/AD9834 Eval Board**. The EVAL-SDP-CB1Z board begins to communicate with the PC.
3. Define MCLK; the default is an on-board 75 MHz oscillator.
4. Ensure that all links are in the correct locations (see Table 1).
5. Select the **FREQ 1** register.
6. Load a 1 MHz excitation frequency and press **Enter**.

The output should appear on the IOUT and IOUTB outputs on the evaluation board.

For the FREQ 0 register, do the following:

1. Select the **FREQ 0** register.
2. Load the **FREQ 0** register with 2 MHz.
3. Press **Enter**.

EVALUATION BOARD SOFTWARE

For the FREQ 1 register, select the **FREQ 1** register to load the 1 MHz associated with this register.

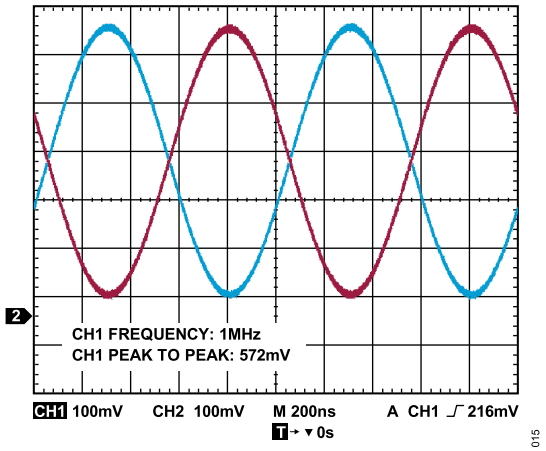

Figure 15. 1 MHz Output Signals on the IOUT and IOUTB Test Points

EVALUATION BOARD SCHEMATICS AND LAYOUT

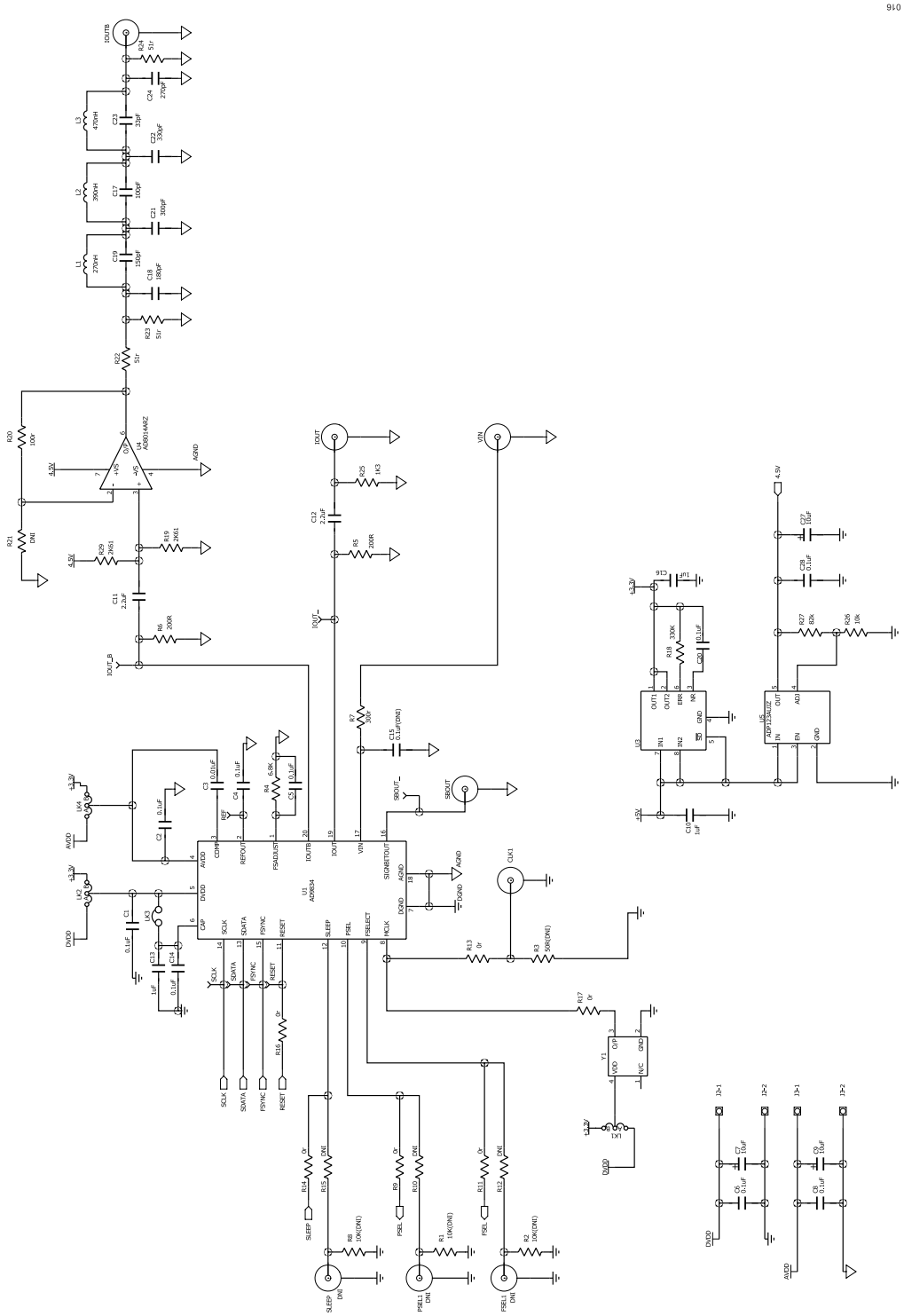

Figure 16. EVAL-CN0304-SDZ Schematic Part A

EVALUATION BOARD SCHEMATICS AND LAYOUT

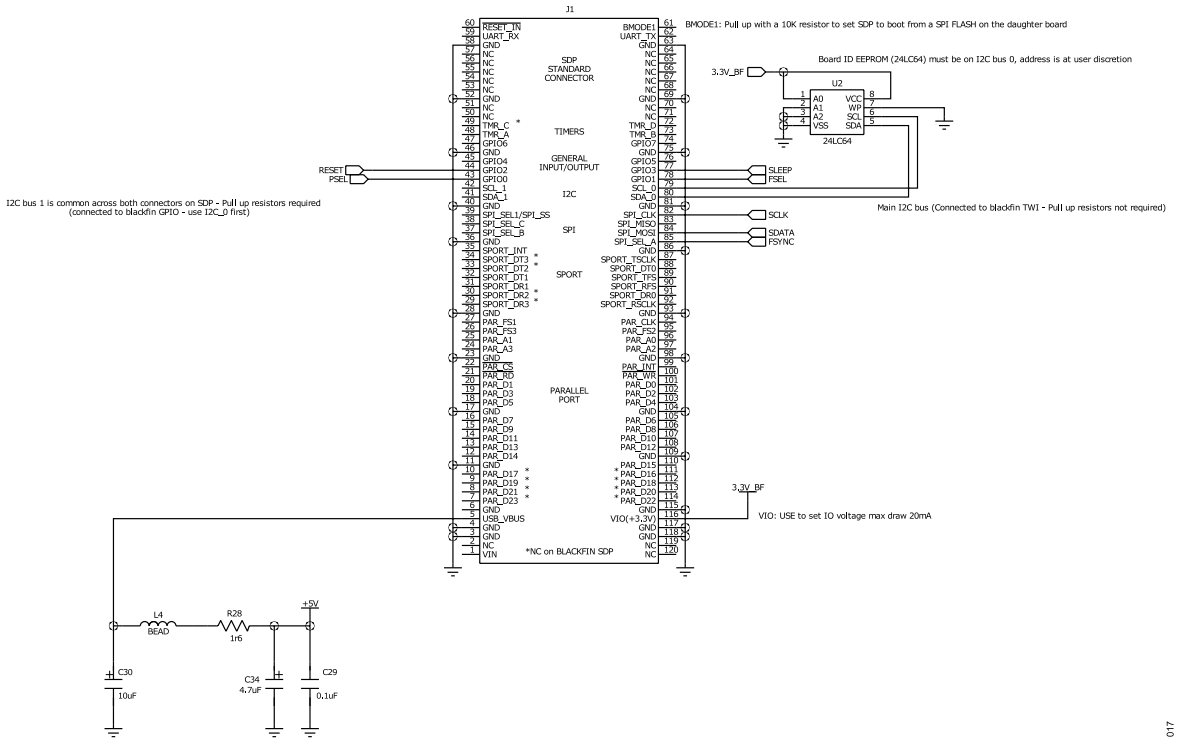

Figure 17. EVAL-CN0304-SDZ Schematic Part B

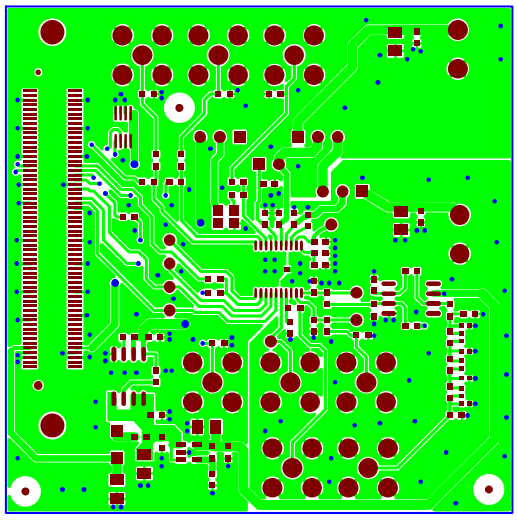

Figure 18. EVAL-CN0304-SDZ Component Side View Layer 1

EVALUATION BOARD SCHEMATICS AND LAYOUT

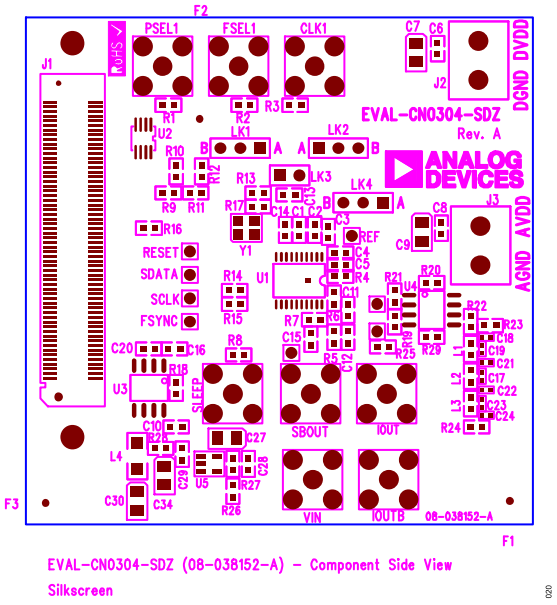

Figure 19. EVAL-CN0304-SDZ Component Side View Silkscreen

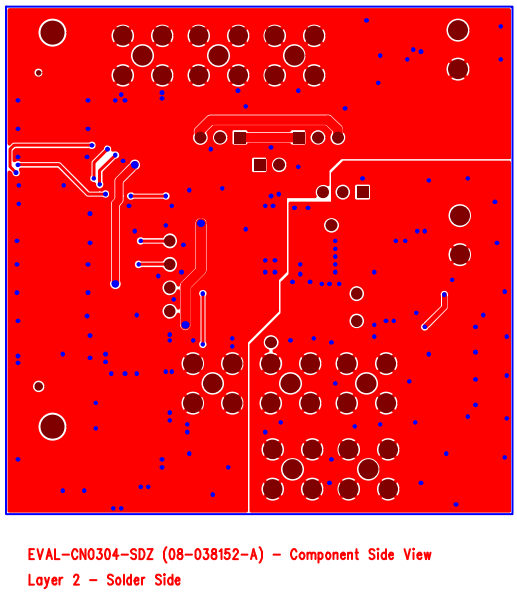

Figure 20. EVAL-CN0304-SDZ Component Side View Layer 2, Solder Side

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Reference Designator	Description	Manufacturer	Part Number
C1 to C6, C8, C14, C15, C28, C29	0.1 µF, ±10%, 50 V, X7R, ceramic capacitors	Murata	GRM188R71H104KA93D
C3	0.01 µF, ±10%, 10 V, 0603, X5R, capacitor	Kemet	C0603C103K5RACTU
C7, C9, C27, C30	10 µF, ±10%,10 V, SMD tantalum capacitors	AVX	TAJA106K010R
C10, C13, C16	1 µF, ±10%,10 V, Y5V, 0603, ceramic capacitors	Yageo	CC0603ZRY5V6BB105
C11, C12	0603, X5R, 10 V, 2.2 µF capacitors	AVX	0603ZD225KAT2A
C20	0.1 µF, ±10%, 16 V, X7R, 0603, capacitor	MultiComp	B0603R104KCT
C17	0402, 100 pF, 50 V capacitor	Murata	GRM1555C1H101JD01D
C19	0402, 150 pF, 50 V capacitor	Murata	GRM1555C1H151JA01D
C18	180 pF, 50 V, 5%, NP0, 0402 capacitor	Murata	GRM1555C1H181JA01D
C24	270 pF, 50 V, 5%, NP0, 0402 capacitor	Murata	GRM1555C1H271JA01D
C21	300 pF, 50 V, 5%, NP0, 0402 capacitor	Murata	GRM1555C1H301JA01D
C22	0402, 330 pF, 50 V capacitor	Murata	GRM1555C1H331JA01D
C23	0402, 33 pF, 50 V capacitor	Murata	GRM1555C1H330JZ01D
C34	Case A, 4.7 µF, 10 V capacitor	AVX	TAJA475K010R
CLK1[1], FSEL1[1], IOUT, IOUTB, PSEL1[1], SBOUT, SLEEP[1]	Straight PCB mount SMB jacks, 50 Ω	Tyco	1-1337482-0
FSYNC, IOUT_, IOUT_B, REF, RESET, SBOUT_, SCLK, SDATA	Red test points	Vero	20-313137
G1	Copper short	Not applicable	Not applicable
J1	120-way connector, 0.6 mm pitch receptacle	HRS (Hirose)	FX8-120S-SV(21)
J2, J3	2-pin terminal blocks (5 mm pitch)	Campden	CTB5000/2
LK1, LK2, LK4	3-pin SIL header and shorting links	Harwin	M20-9990345 and M7567-05
LK3	2-pin SIL header and shorting link	Harwin	M20-9990246
L1	270 nH, 0603	Murata	LQM18NNR27K00D
L2	390 nH, 0603	Murata	LQM18NNR39K00D
L3	470 nH, 0603	Murata	LQM18NNR47K00D
L4	Bead, 600 Ω at 100 MHz	Murata	BLM31AJ601SN1L
R1[1], R2[1], R8[1], R26	10 kΩ, ±1%, 0603, SMD resistors	MultiComp	MC 0.063W 0603 10K
R25	1.3 kΩ, ±1%, 0603, SMD resistor	TE Connectivity/ Neohm	CPF0603F1K33C1
R28	1.6 Ω, ±1%, 0603, SMD resistor	KOA	SG73S1JTTD1R60F
R3[1]	50 Ω, ±1%, 0603, SMD resistor	MultiComp	MC 0.063W 0603 50r
R22, R23, R24	51 Ω, ±1%, 0603, SMD resistors	MultiComp	MC 0.063W 0603 1% 51R
R4	6.8 kΩ, ±1%, SMD resistor	MultiComp	MC 0.063W 0603 6K8
R5, R6	200 Ω, ±1%, SMD resistors	MultiComp	MC 0.063W 0603 200r
R7	300 Ω, ±1%, SMD resistor	MultiComp	MC 0.063W 0603 300r
R27	82 kΩ, ±1%, SMD resistor	Panasonic	ERJ3GEYJ823V
R9, R10[1], R11, R12[1], R13[1], R14, R15[1], R16, R17	0 Ω, ±1%, 0603, SMD resistors	MultiComp	MC 0.063W 0603 0r
R20, R21	100 Ω, ±1%, SMD resistors	MultiComp	MC 0.063W 0603 1% 100R
R18	330 kΩ, ±5%, SMD resistor	MultiComp	MC 0.063W 0603 330KR
R19, R29	2.61 kΩ, ±1%, SMD resistors	MultiComp	MC0063W060312K61
U1	20 mW power, 2.3 V to 5.5 V, 75 MHz complete DDS	Analog Devices	AD9834CRUZ
U2	64 kb I^2C serial EEPROM 8-lead MSOP	Micro Chip	24LC64-I/MS
U3	High accuracy anyCAP® 100 mA low dropout linear regulator	Analog Devices	ADP3301ARZ-3.3
U4	40 MHz, low power, high performance amplifier	Analog Devices	AD8014ARZ
U5	5.5 V input, 300 mA, low quiescent current, CMOS linear regulator, adjustable output voltage	Analog Devices	ADP123AUJZ-R7

ORDERING INFORMATION

Table 2. (Continued)

Reference Designator	Description	Manufacturer	Part Number
Y1	75 MHz, SMD CMOS clock oscillator	KYOCERA AVX	KC3225K75.0000C10E00

[1] Do not install.

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.

Legal Terms and Conditions
By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS ($100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

©2011-2023 Analog Devices, Inc. All rights reserved. Trademarks and registered trademarks are the property of their respective owners.
One Analog Way, Wilmington, MA 01887-2356, U.S.A.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Analog Devices Inc.:

EVAL-CN0304-SDZ