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Evaluation Board for ADF4360-9 Integrated PLL and VCO Frequency Synthesizer

FEATURES

Self-contained board for generating RF frequencies
Flexibility for reference input, PFD frequency, and loop bandwidth
Accompanying software allows complete control of synthesizer functions from a PC
Flexibility for changing external inductor to allow different VCO output frequency ranges
USB-/battery-operated 9 V supplies
Typical DIVOUT jitter performance of 1.4 ps

GENERAL DESCRIPTION

The EV-ADF4360-9EB1Z board is designed to allow the user to evaluate the performance of the ADF4360-9 frequency synthesizer consisting of an integrated PLL and VCO (see Figure 1). It contains the ADF4360-9BCPZ, a USB connector, and SMA connectors for the RF outputs. Unpopulated SMA footprints are available for the power supplies, lock detect, and the external reference input. The evaluation board also contains the loop filter to complete the PLL. It can be modified as necessary for the user's PLL requirements. A USB cable is included with the board to allow software programmability.

The package also contains a CD with Windows® software to allow quick, user-friendly programming of the synthesizer. The CD contains numerous other PLL data sheets, technical notes, articles, and ADIsimPLL™ V3.4, Analog Devices, Inc., PLL simulation software. More information is available at www.analog.com/pll.

EVALUATION BOARD PHOTOGRAPH

Figure 1.

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2/12—Rev. B to Rev. C

Changed EVAL-ADF4360-9EBZ1 to EV-ADF4360-9EB1Z
Throughout 1

11/11—Rev. A to Rev. B

Changes to Features Section, General Description Section, and Figure 1 1
Changes to Evaluation Board Hardware Section and Figure 2 3
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Replaced Evaluation Board Software Section with Evaluation Board Software Quick Start Procedures Section 5
Added Figure 5, Figure 6, and Figure 7; Renumbered Sequentially 5
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8/10—Rev. 0 to Rev. A

Document Title Changed from EVAL-ADF4360-9 to UG-106 ..... Universal
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Changes to Programmable Software Settings Section 5
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9/08—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

The evaluation board comes with a mini-USB cable to connect to the USB port of a PC. The silkscreen for the evaluation board is shown in Figure 2. It is important that the software be installed before connecting the board. If the user encounters any installation warning messages during connection, select **Continue Anyway**. If another **Install hardware procedure wizard** runs when the software is executed, allow it to install.

The board schematics are shown in Figure 11, Figure 12, and Figure 13.

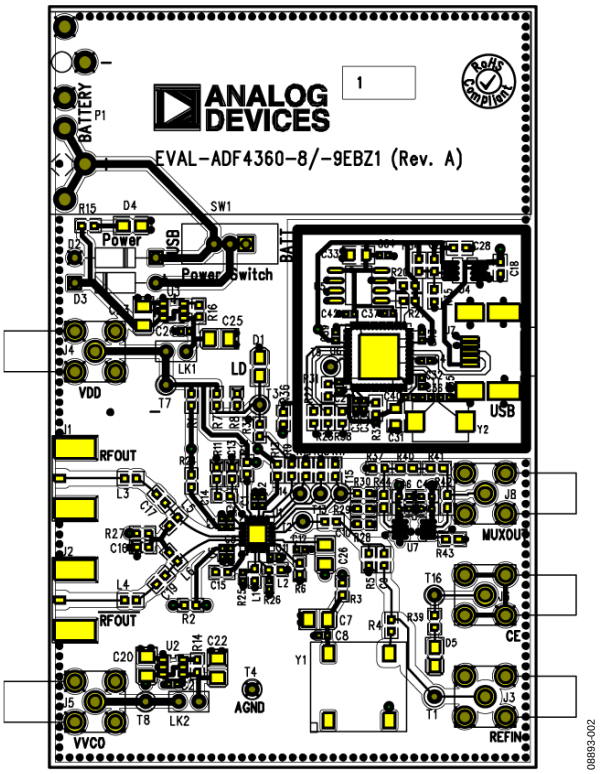

Figure 2. Evaluation Board Silkscreen—Top View

The board is powered from a single 9 V battery or USB connection. All components necessary for local oscillator (LO) or DIVOUT generation are available on board. A 19.2 MHz TCXO from Fox Electronics provides the necessary reference input. Otherwise, an external reference signal can be connected via J3 (to disable the TCXO, remove R3 and R4). The PLL is composed of the ADF4360-9 and a passive loop filter. The VCO output from $RF_{OUT}A$ is available through the standard SMA connector, J1, and the complementary output $RF_{OUT}B$ VCO output is available from J2. DIVOUT is available from J8. Digital lock detect is present on the SMA marked J6.

Users can provide their own power supplies using the J4 and J5 connectors, as shown in Figure 2.

The on-board filter is a third-order, passive low-pass filter. It contains three capacitors (C13, C14, and C15) and two resistors (R10 and R11). The footprint for R10 is located on the underside of the board. The design parameters for the loop filter are for a center frequency of 360 MHz, a PFD frequency of 1600 kHz, and a low-pass filter bandwidth of 40 kHz. To design a filter for different frequency setups, use the ADIsimPLL simulation software.

Note that only very high performance measurement equipment is capable of measuring good jitter performance below 180 MHz. The Agilent E5052A/E5052B and Rohde & Schwarz FSUP are both good instruments for this purpose.

RF OUTPUT STAGE

The RF output stage of the board allows the user to insert a tuned load for a particular frequency. The particular network inserted in the board is optimized for 360 MHz operation. For different frequencies, the output stage needs different component values. Consult the ADF4360-9 data sheet for further information. If in doubt, use a 50 Ω resistor instead of the shunt inductor and a 100 pF bypass capacitor and 0 Ω resistor instead of the series inductor.

It is very important that the same components be placed on the $RF_{OUT}A$ and $RF_{OUT}B$ lines. In addition, it is essential that both outputs be terminated with 50 Ω loads. Otherwise, the output power is not optimal, and, in some cases, the part may malfunction.

In applications that only use the divider, both RF outputs are best terminated with a shunt 50 Ω resistor to AV_{DD}, a series 100 pF dc bypass capacitor, and a 50 Ω load to GND.

EXTERNAL INDUCTOR OPTIONS

The ADF4360-9 uses external inductors (L1 and L2) to set up the LC tank circuit of the VCO. The evaluation board has a footprint for the placement of these. A value of 22 nH is inserted on the board giving a VCO center frequency of 360 MHz. Insert two 470 Ω resistors (R25 and R26) parallel to ground for both L1 and L2 (see Figure 3).

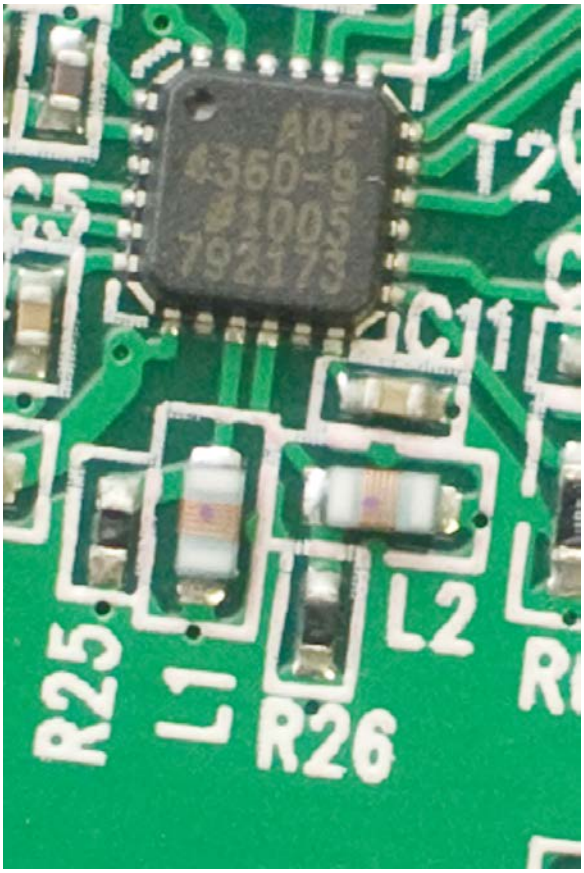

Figure 3. External Inductors and Resistors for the ADF4360-9 Tank Circuit

To find the optimum frequency range for a given inductor, see Figure 4. Ensure that the desired frequency is between the two lines and determine the appropriate inductance needed.

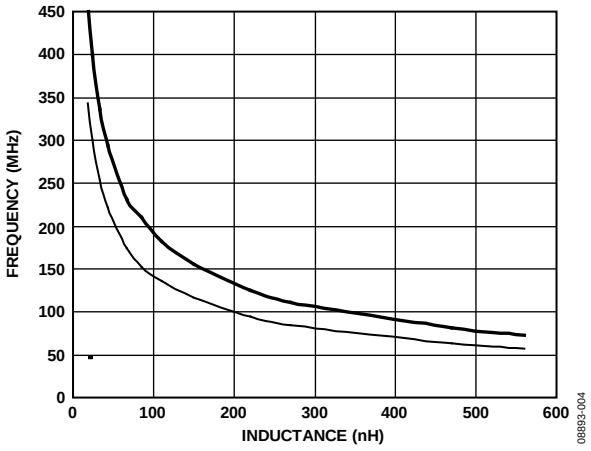

Figure 4. Output Center Frequency vs. External Inductor Value

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

The control software and USB drivers for EV-ADF4360-9EB1Z accompany the EV-ADF4360-9EB1Z on a CD.
To install the software, use the following steps:

1. Open **ADF4360_setup.msi**.
2. The install wizard guides you through the installation process. The software is installed in a default directory called **C:/Program Files/Analog Devices/ADF4360**.

The software requires Microsoft's .NET Framework Version 2.0 or later to be installed on your machine. The installer automatically downloads the framework from the Microsoft website if you do not have this installed. If you do not have an Internet connection or have a slow connection on the PC, you can install the .NET framework directly from the CD. Do this by double-clicking **dotnetfx.exe**. Once installed, run **ADF4360_Setup.msi** again.

WINDOWS XP OS

After you have installed the software, install the USB drivers. To do so, use the following steps:

1. Plug a USB cable into the USB connector on the evaluation board. The **Found New Hardware** box opens. See Figure 5.
2. Choose **Install from a list or specified location (Advanced)**.

Figure 5. New Hardware Wizard

3. Click **Continue Anyway** when asked about Windows Logo testing.
4. If the installation is successful, the message in Figure 6 appears.

Figure 6. Successful Installation

WINDOWS VISTA OS AND WINDOWS 7 (32-BIT) OS

For Windows Vista or Windows 7 (32-bit), you must manually install the drivers. To do so, use the following steps:

1. Find the new unknown device (the evaluation board) in **Device Manager** and double-click it to open the properties. The device should be **Unknown device**, under **Other devices** (see Figure 7).

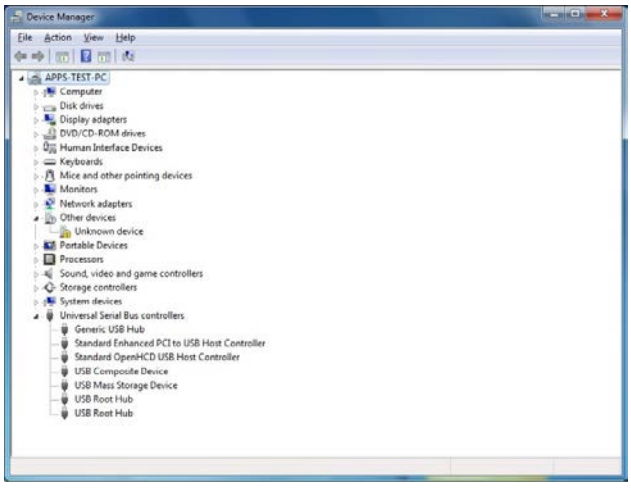

Figure 7. Device Manager

2. Click **Update Driver** in the properties window (see Figure 8).

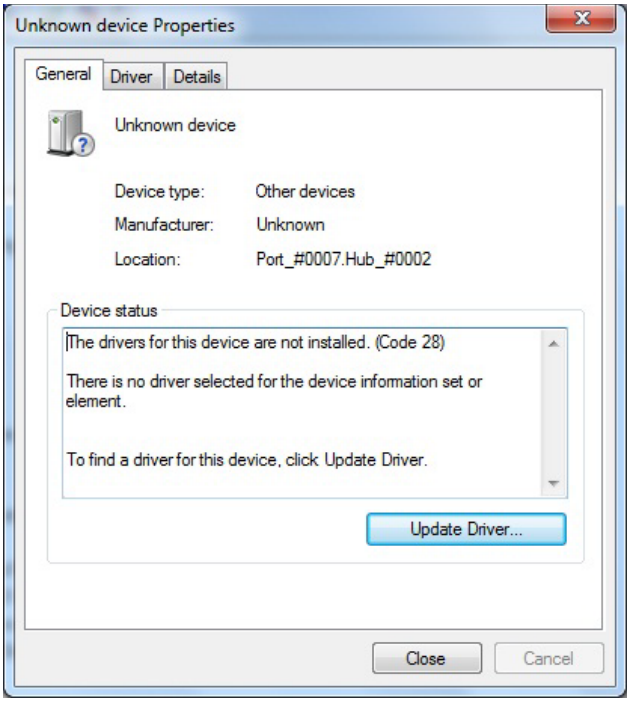

Figure 8. Unknown Device Properties

3. In the **Update Driver Software** dialog box, choose **Browse my computer for driver software**.
4. Browse to **C:\Program Files\Analog Devices\ADF4360**.
5. Click **OK** or **Next**.
6. If prompted by Windows Security, choose **Install this driver software anyway.**
7. If the installation is successful, the message in Figure 9 appears.

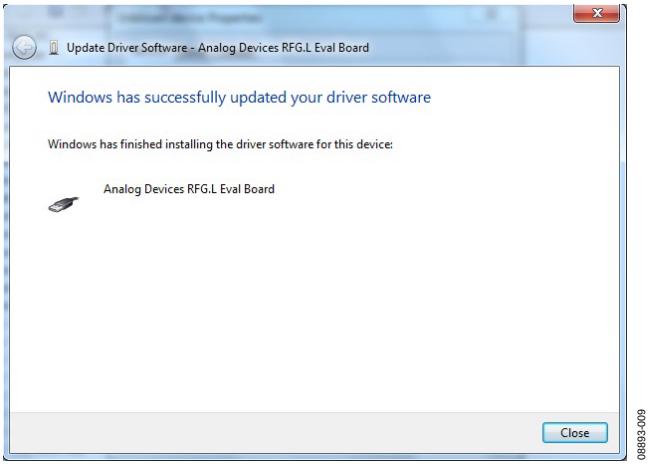

Figure 9. Successful Installation

WINDOWS 7 (64-BIT) OS

Windows 7 64-bit uses a different driver than 32-bit systems. To install this driver:

1. Disconnect the USB evaluation board.
2. Open **ADF4360_setup.msi.**
3. The install wizard guides you through the installation process. The software is installed in a default directory called **C:/Program Files/Analog Devices/ADF4360**.
4. Connect your USB evaluation board. The driver should be found automatically.

Note that installing this driver package disables older versions of Analog Devices PLL software; therefore, only install if needed.

USING THE EVALUATION BOARD SOFTWARE

The control software for the EV-ADF4360-9EB1Z accompanies the EV-ADF4360-9EB1Z on a CD. To install the software, see the Evaluation Board Software Quick Start Procedures section.

To run the software, double-click the **ADF4360.exe** file on the desktop or from the **Start** menu.

The main interface window opens (see Figure 10). Confirm that **Analog Devices RFG.L Eval Board connected** is displayed at the top of the window. Otherwise, the software has no connection to the evaluation board.

The evaluation board can be connected and disconnected while the software is running. Note that when connecting the board, it takes about 5 seconds for the status label to change.

Under the **File** menu, the current settings can be saved to, and loaded from, a text file.

Use the **REF IN Frequency** text box to set the correct reference frequency and the reference frequency divider. The reference TCXO on the evaluation board runs at 19.2 MHz.

The **Settings** section controls the charge pump current setting, the output power setting, and the multiplexer output setting.

Use the **Frequency Settings** section to control the output frequency. You can input the desired output frequency in the **RF Output Frequency** text box (in megahertz). **Div Out Frequency** displays the VCO output frequency available from the output divider.

In the **Registers** tab, you can manually input the desired value to be written to the registers.

In the **Sweep and hop** tab, you can make the device sweep a range of frequencies or hop between two set frequencies.

In the **Latches to write** section at the bottom of the window, the values to be written to each register are displayed. If the background on the text box is green, the value displayed is different from the value actually on the device. Click **Write N counter Latch** or **Write R counter Latch** to write that value to the device.

Press the **F2**, **F3**, and **F4** keys to switch between the three tabs. **F12** increases the output frequency by one channel spacing and writes it to the device. **F11** decreases the output frequency by one channel spacing.

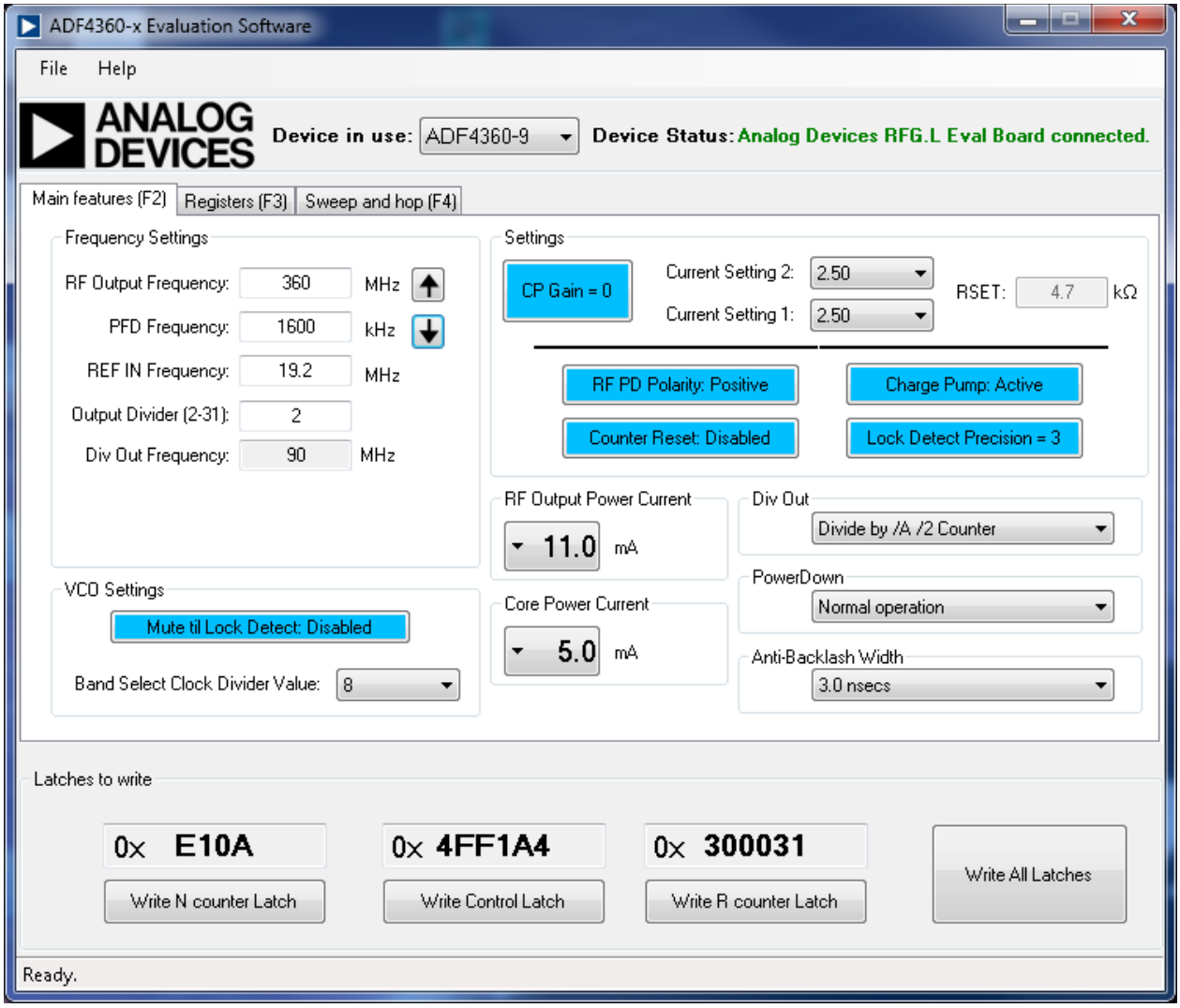

Figure 10. Software Main Interface Window

EVALUATION BOARD SCHEMATICS

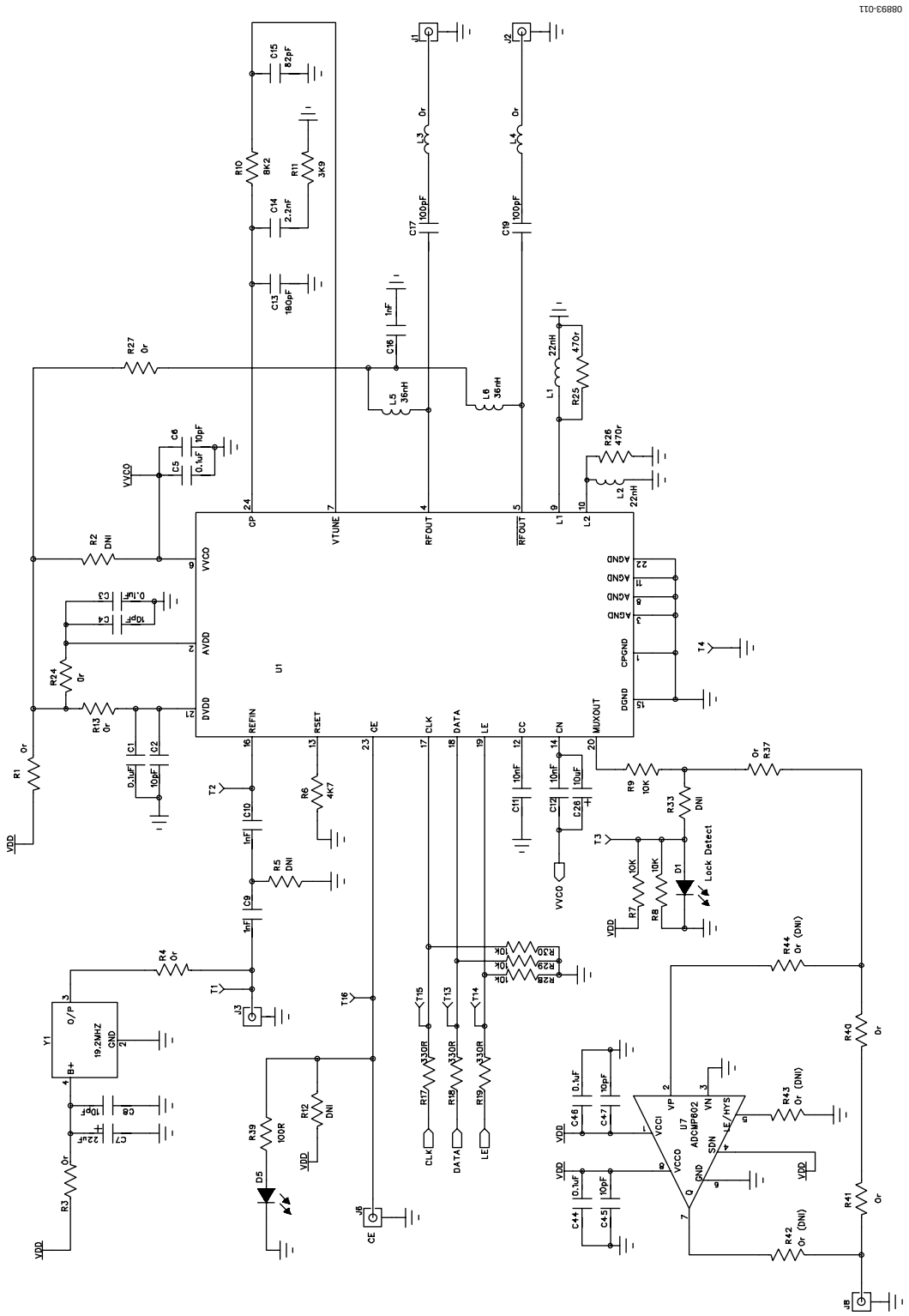

Figure 11. EV-ADF4360-9EB1Z Schematic

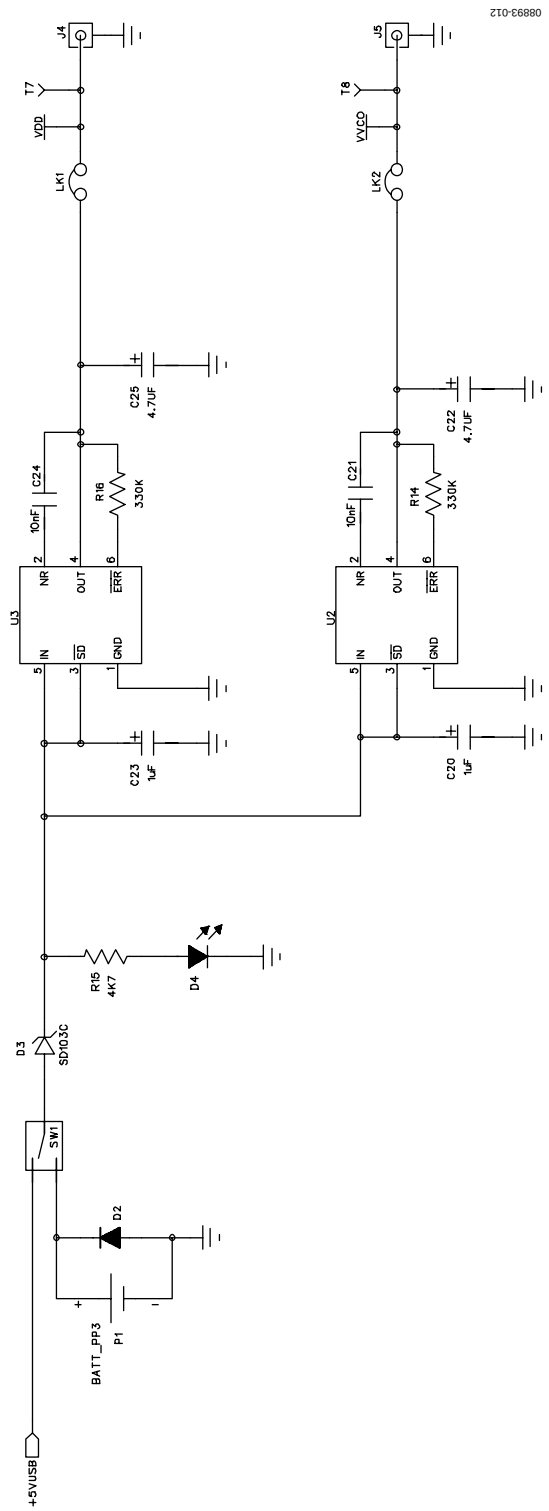

Figure 12. EV-ADF4360-9EB1Z Schematic (Continued)

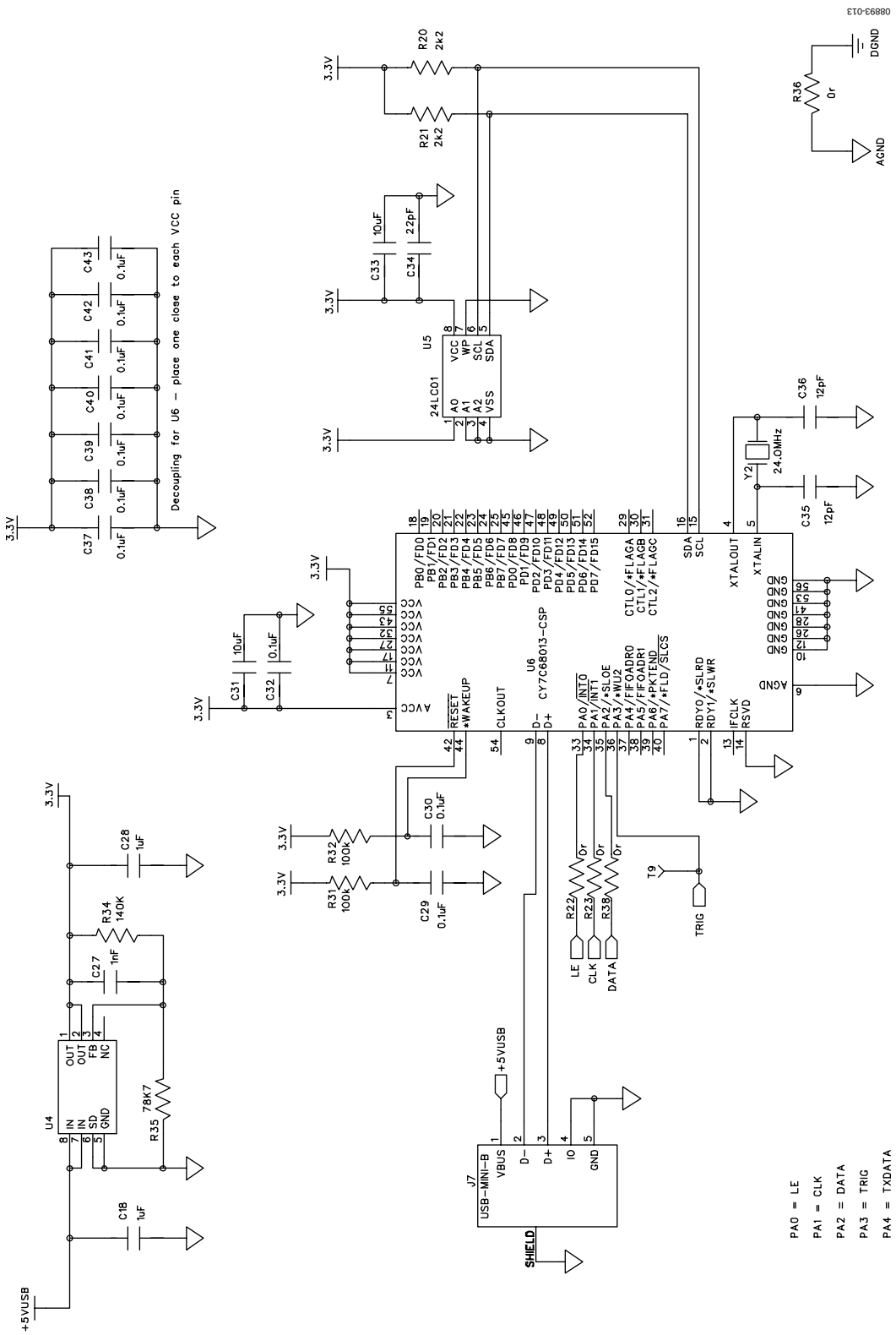

Figure 13. EV-ADF4360-9EB1Z Schematic (Continued)

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Reference Designator	Part Description	Manufacturer/Part No.
C1, C3, C5, C29, C30, C32, C37, C38, C39, C40, C41, C42, C43	Capacitor, 0402, 0.1 µF, 16 V	Kemet C0402C104K4RAC
C2, C4, C6, C8	Capacitor, 0402, 10 pF, 50 V	Kemet C0402C100J5GACTU
C7	Capacitor, Case A, 22 µF, 6.3 V	AVX TAJA226K006R
C9, C10, C27	Capacitor, 0603, 1 nF, 50 V	AVX 06035A102JAT2A
C11, C12, C21, C24	Capacitor, 0402, 10 nF, 16 V	Yageo (Phycomp) CC0402ZRY5V7BB103
C13	2-pin capacitor, 180 pF, 0603, 50 V	Yageo (Phycomp) CC0603KRX7R9BB181
C14	2-pin capacitor, 2.2 nF, 0603, 50 V	Yageo (Phycomp) CC0603KRX7R9BB222
C15	2-pin capacitor, 82 pF, 0603, 50 V	Yageo (Phycomp) CC0603JRNP09BN820
C16	Multilayer ceramic capacitor, 50 V, X7R, 1 nF, ±10%, 0402	Murata GRM155R71H102KA01D
C17, C19	Capacitor, 0603, 100 pF, 50 V	Phycomp 2238 867 15101
C18, C28	Capacitor, 0603, 1 µF, 25 V	Taiyo Yuden TMK107BJ105KA-T
C20, C23	Capacitor, Case A, 1 µF, 16 V	AVX TAJA105K016R
C22, C25	Capacitor, Case A, 4.7 µF, 10 V	AVX TPSA475K010R1400
C26	Capacitor, Case A, 10 µF, 6.3 V	Kemet T491A106M016AT
C31, C33	Capacitor, 0805, 10 µF, 6.3 V	Murata GRM21BR71A106KE51L
C34	Capacitor, 0402, 22 pF, 50 V NPO	Kemet C0402C220J5GACTU
C35, C36	Capacitor 0402, 12 pF, 50V	Kemet C0402C120J5GACTU
D1	LED, SMD red	Avago HSMS-C170
D2	Diode, 1 A, 50 V	Multicomp 1N4001
D3	Schottky diode, 20 V	Micro Commercial Components, Inc., SD103C-TP
D4	LED, SMD red	Avago HSMS-C170
D5	LED, SMD red	Avago HSMS-C170
J1, J2	Jack SMA end launch tab	Johnson Components 142-0701-851
J3 to J6	Jack SMA end launch tab (not inserted)	
J7	USB mini-B	Molex 56579-0576
L1, L2	Ceramic chip inductor, 220 nH, 5%, 0603 for ADF4360-9 only	Coilcraft 0603CS-22NX_LU
L3, L4	Resistor, 0603, 0 Ω	Multicomp MC 0.063W 0603 0R
L5, L6	Ceramic chip inductor, 240 nH, 5%, 0603	Coilcraft 0603LS-36NX_LU
LK1, LK2	Header, 1-row, 2-way and jumper socket black	Harwin Plc M20-9990245 and Harwin Plc M7567-05
P1	Battery clip, PCB mounting	Keystone Electronics Corp. 593+594
R1 to R4, R9, R13, R22 to R24, R27, R36, R37, R40, R41,R38	Resistor, 0603, 0 Ω	Multicomp MC 0.063W 0603 0R
R5	Resistor, 0603, 51 Ω	Multicomp MC 0.063W 0603 1% 51R
R6, R15	Resistor, 0603, 4.7 kΩ	Multicomp MC 0.063W 0603 1% 4K7
R7, R8, R12, R28, R29, R30	Resistor, 0603, 10 kΩ	Multicomp MC 0.063W 0603 1% 10K
R10	2-pin resistor, 12 kΩ, 0603, 1%	Multicomp MC 0.063W 0603 1% 8K2
R11	2-pin resistor, 5.1 kΩ, 0603, 1%	Multicomp MC 0.063W 0603 1% 3K9
R14, R16	Resistor, 0603, 330 kΩ	Multicomp MC 0.063W 0603 1% 330K
R17 to R19	Resistor, 0603, 330 Ω	Multicomp MC 0.063W 0603 1% 330R
R20, R21	Resistor, 0603, 2.2 kΩ	Multicomp MC 0.063W 0603 1% 2K2

Reference Designator	Part Description	Manufacturer/Part No.
R25, R26	Resistor, 0402, 470 Ω	Multicomp MC 0.063W 0402 1% 470R
R31, R32	Resistor, 0603, 100 kΩ	Multicomp MC 0.063W 0603 1% 100K
R34	Resistor, 0603, 140 kΩ	Multicomp MC 0.063W 0603 1% 140K
R35	Resistor, 0603, 78.7 kΩ	Multicomp MC 0.063W 0603 1% 78K7
SW1	Switch, PCB SPDT	APEM TL36P0050
T1 to T8, T13 to T16	Terminal, PCB, red, PK100	Vero Technologies, Ltd. 20-313137
T9 to T12	Test point (not inserted)	
U1	Integrated integer-N synthesizer	Analog Devices ADF4360-9BCPZ
U2, U3	High accuracy low dropout linear 3 V regulator	Analog Devices ADP3300ARTZ-3
U4	ADP3334 adjustable LDO regulator	Analog Devices ADP3334ARMZ
U5	IC serial EEPROM 8-SOIC	Microchip 24LC64-ISN
U6	USB microcontroller	Cypress CY7C68013A-56LFXC
U7	ADCMP602 comparator	Not inserted
Y1	19.2 MHz TCXO (FOX801)	Fox Electronics FOX801-BELF
Y2	24 MHz XTAL	ECS ECS-240-12-20A-TR

RELATED LINKS

Resource	Description
ADF4360-9	Product Page, Clock Generator PLL with Integrated VCO
ADP3300	Product Page, High Accuracy anyCAP® 50 mA Low Dropout Linear Regulator
ADP3334	Product Page, High Accuracy Low IQ, 500 mA anyCAP® Adjustable Low Dropout Regulator
ADCMP602	Product Page, Rail-to-Rail, Very Fast, 2.5 V to 5.5 V, Single-Supply TTL/CMOS Comparator in 8-Lead MSOP and LSCFP Packages

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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.

UG08893-0-2/12(C)

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