Evaluation Board for ADF4360-1 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
USB/battery-operated 9 V supplies
Typical phase noise performance of −141 dBc/Hz at 3 MHz offset
Typical spurious performance of −70 dBc at 200 kHz offset (2.0 GHz output)

GENERAL DESCRIPTION
The ADF4360-1EBZ1 evaluation board is designed to allow the user to evaluate the performance of the ADF4360-1 frequency synthesizer consisting of an integrated PLL and VCO (see Figure 1). It contains the ADF4360-1BCPZ, a USB connector, and SMA connectors for the RF outputs. Unpopulated SMA footprints are available for the power supplies, the chip enable (CE), 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 PLL requirements of the user. A USB cable is included with the board to allow software programmability from a PC.

The package also contains a CD with Windows® software to allow quick, user-friendly programming of the synthesizer. The CD contains additional 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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REVISION HISTORY
9/11—Rev. 0 to Rev. A
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7/10—Revision 0: Initial Version
EVALUATION BOARD HARDWARE

The evaluation board comes with a cable to connect it to the USB port of a PC. The silkscreen and cable diagram for the evaluation board are shown in Figure 2. The board schematics are shown in Figure 9 through Figure 11.

The board is powered from a single 9 V battery, or from the USB supply, by changing the position of Switch SW1. All components necessary for LO generation are catered for on-board. A 10 MHz TCXO from Fox Electronics provides the necessary reference input. Otherwise, an external reference signal can be connected via J3. The PLL comprises the ADF4360-1BCPZ and a passive loop filter. The VCO output from RFOUTA is available through the standard SMA Connector J1 and the complementary RFOUTB VCO output is available from J2.

Users may provide their own power supplies using the J4 and J5 connectors, as shown in Figure 2. Hardware power-down using the CE pin can be controlled by inserting an SMA connector into J6 and removing R12.

The on-board filter is a third-order, passive, low-pass filter. The filter contains three capacitors (C13, C14, and C15) plus 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 2250 MHz, a PFD frequency of 200 kHz, and a low-pass filter bandwidth of 10 kHz. To design a filter for different frequency setups, use the ADIsimPLL simulation software.

RF OUTPUT STAGES

The output stage of the board contains a tuned load for the particular frequency of operation. The particular network inserted in the board is optimized for 2250 MHz operation. This consists of a 1 nH shunt inductor, a 10 pF series capacitor, and a 1 nH series inductor. If in doubt, use a 50 Ω resistor instead of the shunt inductor, a 100 pF bypass capacitor, and a series 0 Ω resistor. It is important that the same components be placed on the RFOUTA and RFOUTB lines. In addition, it is essential that both outputs be terminated with 50 Ω loads. Otherwise, the output power is not optimum, and in some cases, the part may malfunction.
EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

The control software and USB drivers for EVAL-ADF4360-1EBZ1 accompany the EVAL-ADF4360-1EBZ1 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 and USB drivers will be installed in the 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, then you can install the .NET framework directly from the CD. Do this by double-clicking dotnetfx.exe. Once installed, run the ADF4360_Setup.msi again.

WINDOWS XP OS

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

1. Plug in a USB cable to the USB connector on the evaluation board. The Found New Hardware box appears. See Figure 3.
2. Choose Install from a list or specified location (Advanced).
3. Browse to C:\Program Files\Analog Devices\ADF4360 or the location where you installed the ADF4360 software.
4. Click Continue Anyway when asked about Windows Logo testing.
5. If the install was successful, the message box in Figure 4 appears.

Figure 3. New Hardware Wizard

Figure 4. Successful Install
WINDOWS VISTA OS AND WINDOWS 7 (32-BIT) OS

For Windows Vista or Windows 7 (32-bit), you need to 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 5).

2. Click Update Driver in the properties window (see Figure 6).

3. On 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 install was successful, the message box in Figure 7 appears.

Figure 5. Device Manager

Figure 6. Unknown Device Properties

Figure 7. Successful Install

WINDOWS 7 64-BIT OS

If you are using Windows 7 64-bit OS, it is recommended to download Windows XP Mode (a Windows XP emulator) from Microsoft to run the evaluation board software.

Windows XP Mode allows the device driver package to digitally sign allowing you to use Windows 7 64-bit OS in native mode.
USING THE EVALUATION BOARD SOFTWARE

The control software for the EVAL-ADF4360-xEBZ1 accompanies the EVAL-ADF4360-xEBZ1 on a CD. To install the software, see the Evaluation Board Software Quick Start Procedures section.

To run the software, click the ADF4360.exe file on the desktop or in the Start menu.

The main interface window appears (Figure 8). Confirm that Analog Devices RFG1 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 10 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. The user can input the desired output frequency in the RF Output Frequency text box (in megahertz).

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

In the Sweep and hop tab, the user 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, then the value displayed is different to the value actually on the device. Click Write x Latch to write that value to the device.

The Write All Latches button writes to each register.

The F2, F3, and F4 keys switch between the three tabs.
Figure 8. Software Front Panel Display
Figure 9. EVAL-ADF4360-1EBZ1 Schematic
Figure 10. EVAL-ADF4360-1EBZ1 Schematic (Continued)
Figure 11. EVAL-ADF4360-1EBZ1 Schematic (Continued)
## ORDERING INFORMATION

### BILL OF MATERIALS

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<th>Reference Designator</th>
<th>Part Description</th>
<th>Manufacturer/Part No.</th>
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</thead>
<tbody>
<tr>
<td>C1, C3, C5, C29, C30, C32, C37, C38, C39, C40, C41, C42, C43</td>
<td>Capacitor, 0402, 0.1 µF, 16 V</td>
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<td>AVX TAJA226K006R</td>
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<td>C15</td>
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<td>Phy comp 2238 B61 15391</td>
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<td>LED, SMD red</td>
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<td>D3</td>
<td>Schottky diode, 20 V</td>
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<td>D4</td>
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<td>J1, J2</td>
<td>Jack SMA end launch tab</td>
<td>Johnson Components 142-0701-851</td>
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<td>USB mini-B</td>
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<tr>
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<td>P1</td>
<td>Battery clip, PCB mounting</td>
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<td>Resistor, 0603, 0 Ω</td>
<td>Multicomp MC 0.063W 0603 1% 4K7</td>
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<tr>
<td>R5</td>
<td>Resistor, 0603, 51 Ω</td>
<td>Multicomp MC 0.063W 0603 1% 4K7</td>
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<td>R6, R15</td>
<td>Resistor, 0603, 4.7 kΩ</td>
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<tr>
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<td>Resistor, 0603, 100 Ω</td>
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<td>R10</td>
<td>Resistor, 0603, 20 kΩ</td>
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<td>R11</td>
<td>Resistor, 0603, 330 kΩ</td>
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<tr>
<td>R14, R16</td>
<td>Resistor, 0603, 100 kΩ</td>
<td>Multicomp MC 0.063W 0603 1% 4K7</td>
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<tr>
<td>R17 to R19</td>
<td>Resistor, 0603, 330 Ω</td>
<td>Multicomp MC 0.063W 0603 1% 4K7</td>
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<tr>
<td>R20, R21</td>
<td>Resistor, 0603, 470 Ω</td>
<td>Multicomp MC 0.063W 0603 1% 4K7</td>
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<td>R25, R26</td>
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<td>R31, R32</td>
<td>Resistor, 0603, 140 kΩ</td>
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<td>R34</td>
<td>Resistor, 0603, 78.7 kΩ</td>
<td>Multicomp MC 0.063W 0603 1% 4K7</td>
</tr>
</tbody>
</table>
### Reference Designator | Part Description | Manufacturer/Part No.
--- | --- | ---
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) | Analog Devices, ADF4360-1BCPZ
U1 | Integrated integer-N synthesizer | Analog Devices, ADP3300ARTZ-3
U2 | High accuracy low dropout linear 5 V regulator | Analog Devices, ADP3300ARTZ-3
U3 | High accuracy low dropout linear 3 V regulator | Analog Devices, ADP3334ARMZ
U4 | ADP3334 Adjustable LDO regulator | Microchip 24LC64-1SN
U5 | IC Serial EEPROM 8-SOIC | Cypress CY7C68013A-56LFXC
U6 | USB Microcontroller | Fox Electronics FOX801-BELF
Y1 | 10 MHz TCXO (FOX801) |

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