Evaluating the **ADF4356** Microwave Wideband Synthesizer with Integrated VCO

**FEATURES**
Self contained board, including **ADF4356** frequency synthesizer with integrated VCO, differential, 122.88 MHz, temperature controlled crystal oscillator (TCXO), loop filter (80 kHz), USB interface, and voltage regulators
Windows-based software allows control of synthesizer functions from a PC
Externally powered by 5.5 V

**EVALUATION KIT CONTENTS**
**EV-ADF4356SD1Z**

**EQUIPMENT NEEDED**
Windows-based PC with USB port for evaluation software
System demonstration platform, serial only (**SDP-S**)
**EVAL-SDP-CS1Z** controller board
USB cable (included with the **EVAL-SDP-CS1Z**)
Power supply (5.5 V)
Spectrum analyzer
50 Ω terminators

**ONLINE RESOURCES**

**Documents Needed**
- **ADF4356** data sheet
- **EV-ADF4356SD1Z** user guide
- PLL Software Installation Guide

**Required Software**
- Analog Devices, Inc., **ADF4356** software, Version 1.0.10 or higher

**GENERAL DESCRIPTION**
The **EV-ADF4356SD1Z** evaluates the performance of the **ADF4356** frequency synthesizer with an integrated voltage control (VCO) for phase-locked loops (PLls). The evaluation board contains the **ADF4356** frequency synthesizer with an integrated VCO, a differential 122.88 MHz reference (TCXO), a loop filter, a USB interface, power supply connectors, and subminiature Version A (SMA) connectors. A USB cable is included to connect the board to a PC USB port.

This board requires an **SDP-S** (shown in Figure 1, but not supplied with the kit). The **SDP-S** allows software programming of the **EV-ADF4356SD1Z**.

When working with the evaluation board and for full specifications of the device, consult the **ADF4356** frequency synthesizer data sheet. For easy programming of the synthesizer, download the Windows®-based software from the **ADF4356** product page.

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**EVALUATION BOARD PHOTOGRAPH**

![EVALUATION BOARD PHOTOGRAPH](image)

Figure 1.
# TABLE OF CONTENTS

Features .............................................................................................. 1
Evaluation Kit Contents..................................................................... 1
Equipment Needed ............................................................................. 1
Online Resources .............................................................................. 1
General Description .......................................................................... 1
Evaluation Board Photograph ............................................................ 1
Revision History ............................................................................... 2
Getting Started .................................................................................. 3
  Software Installation Procedures ................................................ 3
  Evaluation Board Setup Procedures ........................................... 3
Evaluation Board Hardware ............................................................... 4
  Power Supplies .............................................................................. 4
RF Output ............................................................................................. 4
Loop Filter ............................................................................................ 4
Reference Source .............................................................................. 4
Default Configuration ....................................................................... 4
Evaluation Board Setup .................................................................... 5
Evaluation Board Software ............................................................... 6
  Main Controls ................................................................................. 6
Evaluation and Test ........................................................................... 7
  Evaluation Board Schematics and Artwork ................................... 8
Ordering Information ......................................................................... 12
  Bill of Materials ............................................................................. 12

# REVISION HISTORY

04/2017—Rev. 0 to Rev. A

  Changes to Features, Evaluation Kit Contents, Equipment Needed, Online Resources Sections, and Figure 1 ............. 1
  Changes to Figure 2 ........................................................................ 3
  Changes to Evaluation Board Hardware Section and Deleted Figure 3, Renumbered Sequentially ....................... 4
  Changes to Figure 3 ........................................................................ 5
  Changes to Evaluation Board Software, Step 5 and Figure 5 ...... 7
  Changes to Figure 6 ........................................................................ 8
  Changes to Figure 7 ........................................................................ 9
  Deleted Figure 8, Renumbered Sequentially................................. 9
  Changes to Figure 8, Figure 9, and Figure 10 ......................... 10
  Deleted Figure 11, Renumbered Sequentially............................. 11
  Changes to Figure 11 ................................................................. 11
  Changes to Figure 12 ................................................................. 12
  Changes to Table 1 ................................................................. 13

10/2016—Revision 0: Initial Version
GETTING STARTED

SOFTWARE INSTALLATION PROCEDURES

See the ADF4356 product page for the EV-ADF4356SD1Z control software. For the software installation procedure, see the PLL Software Installation Guide.

EVALUATION BOARD SETUP PROCEDURES

To run the software,

1. Click the ADF4356 file on the desktop or from the Start menu.
2. On the Select Device and Connection tab, choose ADF4356 and SDP board (black), and then click Connect (see Figure 2).
3. When connecting the board, allow 5 sec to 10 sec for the label on the status bar to change.

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

Figure 2. Software Front Panel Display—Select Device and Connection
EVALUATION BOARD HARDWARE

The **EV-ADF4356SD1Z** requires the **SDP-S** platform that uses the **EVAL-SDP-CSR1Z** (SDP-B is not recommended).

The **EV-ADF4356SD1Z** schematics are shown in Figure 6, and Figure 7. The evaluation board silkscreen is shown in Figure 8.

POWER SUPPLIES

The board is powered by a 5.5 V power supply connected to the red and black banana connectors. Connect the red connector to a 5.5 V power supply and the black connector to ground. Reversal of the connections to the red and black banana connectors can cause catastrophic failure of the HMC1060 low noise regulator.

The **HMC1060** low noise regulator is configured to supply 5 V for the charge pump and VCO supply pins, and 3.3 V for the remaining supply pins.

RF OUTPUT

The **EV-ADF4356SD1Z** has two pairs of SMA output connectors: RFOUTA+/RFOUTA− and RFOUTB+/RFOUTB− (differential outputs). Because they are sensitive to impedance mismatch, connect the RF outputs to equal load impedances. If only one port of a differential pair is used, terminate the complementary port with an equal load terminator (in general, a 50 Ω terminator).

LOOP FILTER

The loop filter schematic is included in the board schematic in Figure 6. For lowest rms phase noise, use the following components (that are inserted on the evaluation board) with a 0.9 mA charge pump current:

- C22 = 120 pF, C29 = 2700 pF, C33 = 22 pF
- R33 = 2.7 kΩ, R34 = 10 kΩ

Narrower loop filter bandwidths have lower spurious signals.

REFERENCE SOURCE

The evaluation board contains a 122.88 MHz differential output TCXO from Vectron International. If preferred, the user may supply either a single-ended or differential reference input to REFINA/REFINB SMA connectors. When using an external reference, remove R7 to disconnect the power rail to the TCXO.

To use a single-ended REFINx, connect a low noise, 122.88 MHz reference source to the REFINA SMA connector. Remove Resistor R6 (100 Ω) and insert R10 (50 Ω) and R15 (50 Ω).

To use a differential REFINx, connect the differential signal to the REFINA and the REFINB SMA connectors. The differential REFINA/REFINB SMA connectors can operate to a 500 MHz input frequency.

DEFAULT CONFIGURATION

All components necessary for local oscillator (LO) or clock generation are inserted on the board. This board is shipped with the **ADF4356** synthesizer with an integrated VCO, a differential 122.88 MHz reference TCXO, and a 80 kHz loop filter (I<sub>CP</sub> = 0.9 mA).
EVALUATION BOARD SETUP

Figure 3. Evaluation Setup Block Diagram
EVALUATION BOARD SOFTWARE

MAIN CONTROLS

The Main Controls tab (see Figure 4) selects the RF and user configurable register settings. Consult the register descriptions of the ADF4356 data sheet for details. Default settings are recommended for most registers.

In the RF Settings section, ensure that the VCOout (MHz) box equals the VCO frequency. Set the Output divider dropdown menu to give the required RfoutA± (MHz). Ensure that the Reference freq. value equals the applied reference signal. The PFD frequency is calculated from the reference frequency, the R counter, the reference doubler, and the reference divide by 2. Ensure that the value in PFD (MHz) matches the value specified in the loop filter design.

In the Register 4 section, program the CP current dropdown menu to match the value used for the loop filter design.

![Figure 4. Software Front Panel Display—Main Controls](image)
EVALUATION AND TEST

To evaluate and test the performance of the ADF4356, use the following procedure:

1. Install the ADF4356 software (see the PLL Software Installation Guide).
2. Follow the hardware driver installation procedure (Windows XP only).
3. Connect a 50 Ω terminator to RFOUTA−.
4. Connect the EV-ADF4356SD1Z board to the SDP-S board.
5. Connect the 5.5 V power supply to the banana connectors and power on the board.
6. Connect the USB cable from the SDP-S board to the PC.
7. Run the ADF4356 software.
8. Select ADF4356 and SDP board (black) in the Select Device and Connection tab of the software front panel display window (see Figure 2).
9. Click the Main Controls tab, and set the VCOout (MHz) to a frequency of 5000 MHz.
10. Click Write Init. Seq.
11. Connect the spectrum analyzer to SMA connector RFOUTA+, see Figure 3 for a typical evaluation setup.
12. Measure the output spectrum and single-sideband phase noise.

Figure 5 shows a phase noise plot of the SMA RFOUTA+ equal to 5 GHz.
Figure 6. Evaluation Board Schematic—Page 1
Figure 7. Evaluation Board Schematic—Page 2
Figure 8. Evaluation Board Silk Screen

Figure 9. Evaluation Board Layer 1—Primary

Figure 10. Evaluation Board Layer 2—Ground
Figure 11. Evaluation Board Layer 3—Power

Figure 12. Evaluation Board Layer 4—Secondary
## ORDERING INFORMATION

### BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Description</th>
<th>Value</th>
<th>Manufacturer</th>
<th>Product No.</th>
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<tr>
<td>C1 to C3, C7, C27, C28, C30 to C32, C34, C45, C67</td>
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<td>Panasonic</td>
<td>ERJ-6ENF1003V</td>
</tr>
</tbody>
</table>

¹ Components N/A
**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 One Technology Way, Norwood, MA 02062, USA. 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.

**Reference Designator** | **Description** | **Value** | **Manufacturer** | **Product No.**
--- | --- | --- | --- | ---
RE3 | Do not install PCB connector, coaxial SMA end launch | N/A\(^1\) | N/A\(^1\) | N/A\(^1\)
REFINA, REFINB | PCB connector, coaxial SMA RA jack connectors | N/A\(^1\) | Cinch Connectivity Solutions | 142-0701-801
RFOUTA+, RFOUTA−, RFOUTB+, RFOUTB− | PCB connector, SMA RA jack connectors | N/A\(^1\) | Rosenberger Hochfrequenztechnik GMBH & Co. | 32K243-4OML5
U1 | IC, Analog Devices, quad, low noise, high PSRR, linear voltage regulator | N/A\(^1\) | Analog Devices | HMC1060LP3E
U3 | IC, Analog Devices, microwave wideband synthesizer with integrated VCO | N/A\(^1\) | Analog Devices | ADF4356BCPZ
UE1 | 32 kHz serial EEPROM | N/A\(^1\) | Microchip Technology | 24LC32A-I/M5
VSUPPLY_ALT | PCB connector, single socket, red | N/A\(^1\) | Deltron | 571-0500
Y1 | IC crystal LVPECL, LVDS oscillator | 122.88 MHz | Vectron International | VCC6-LAB-122M880000

\(^1\) N/A means not applicable.