

## Evaluation Board for ADF4360-7 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 the external inductor to allow different VCO output frequency ranges**
- USB/battery-operated 9 V supplies**
- Typical phase noise performance of  $-143$  dBc/Hz at 3 MHz offset**
- Typical spurious performance of  $-70$  dBc at 200 kHz offset (900 MHz output)**

### GENERAL DESCRIPTION

The EV-ADF4360-7EB1Z evaluation board is designed to allow the user to evaluate the performance of the [ADF4360-7](#) frequency synthesizer consisting of an integrated PLL and VCO (see Figure 1). It contains the ADF4360-7BCPZ, 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 cable is included with the board to connect a PC parallel port 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 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](http://www.analog.com/pll).

### EVALUATION BOARD PHOTOGRAPH



Figure 1.

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**REVISION HISTORY**

**2/12—Rev. A to Rev. B**

Changed ADF4360-7EBZ1 to ADF4360-7EB1Z ..... 1  
 Changed EVAL-ADF4360-7EBZ1 to EV-ADF4360-7EB1Z  
 Throughout .....5  
 Changed EVAL-ADF4360-xEBZ1 to EV-ADF4360-7EB1Z.....7

**6/11—Rev. 0 to Rev. A**

Changes to Features Section ..... 1  
 Added Evaluation Board Software Quick Start Procedures  
 Section.....5  
 Changes to Using the Evaluation Board Software Section .....7  
 Changes to Evaluation Board Schematic Section.....9  
 Changes to Bill of Materials Section ..... 12

**7/10—Revision 0: Initial Version**



**EXTERNAL INDUCTOR OPTIONS**

The ADF4360-7 uses external inductors (L1 and L2) to set up the LC tank circuit of the VCO. The evaluation board has a footprint for placing these inductors. A value of 3.9 nH is inserted on the board giving a VCO center frequency of 900 MHz. For this inductor value and for other inductor values of greater than 3.3 nH, a 470 Ω resistor in parallel to ground for both L1 and L2 must be inserted, as shown in Figure 3.



Figure 3. External Inductors and Resistors for ADF4360-7 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 read off the appropriate inductance needed.

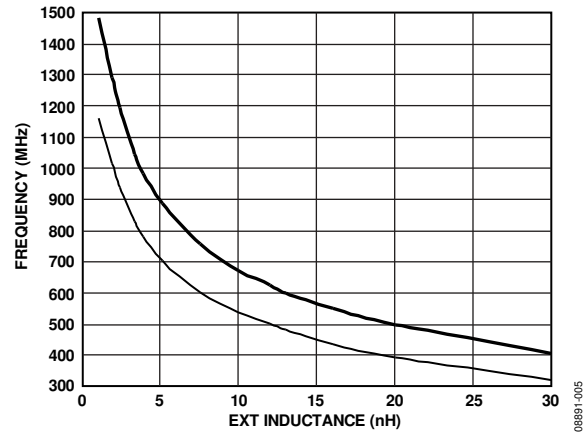


Figure 4. Output Center Frequency vs. External Inductor Value

## EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

The control software and USB drivers for EV-ADF4360-7EB1Z accompany the EV-ADF4360-7EB1Z 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, 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 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 install was successful, the message box in Figure 6 appears.



Figure 6. 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 7).

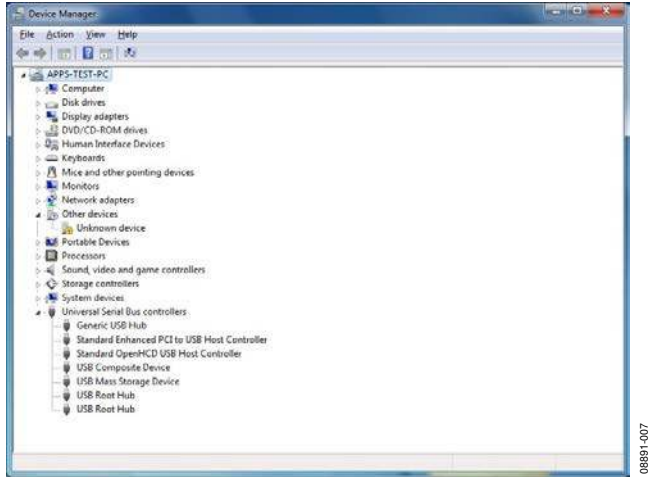


Figure 7. Device Manager

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

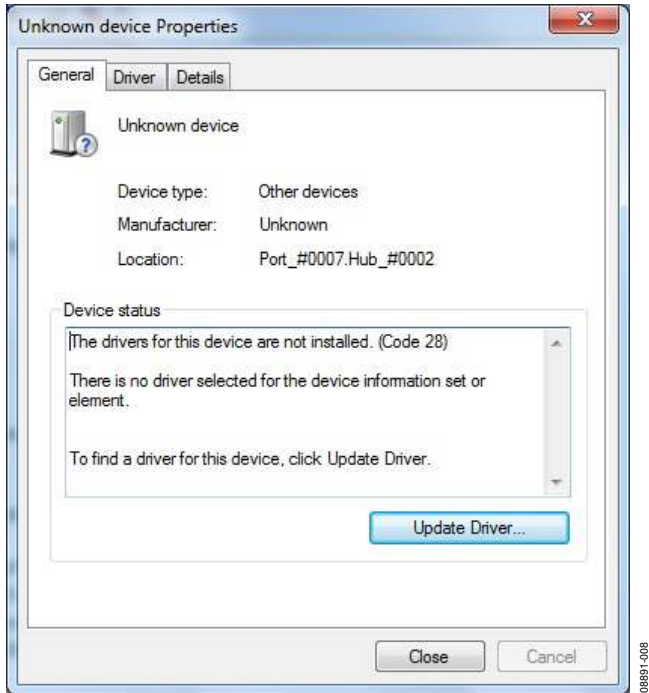


Figure 8. Unknown Device Properties

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 9 appears.

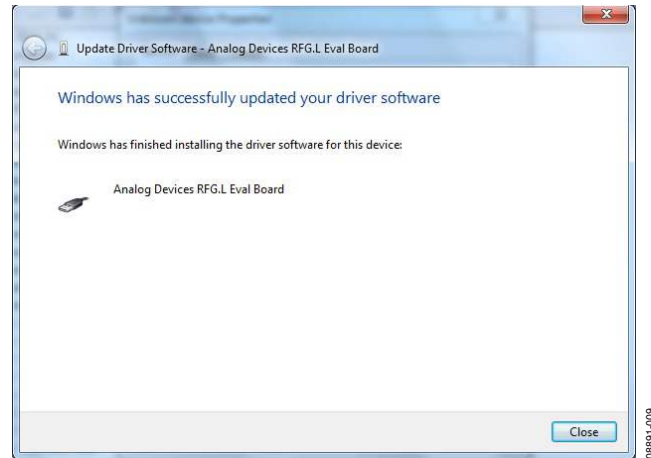


Figure 9. Successful Install

**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 EV-ADF4360-7EB1Z accompanies the EV-ADF4360-7EB1Z 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 (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 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 **Sweeps 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 counter Latch** to write that value to the device.

The **F2**, **F3**, and **F4** keys 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.

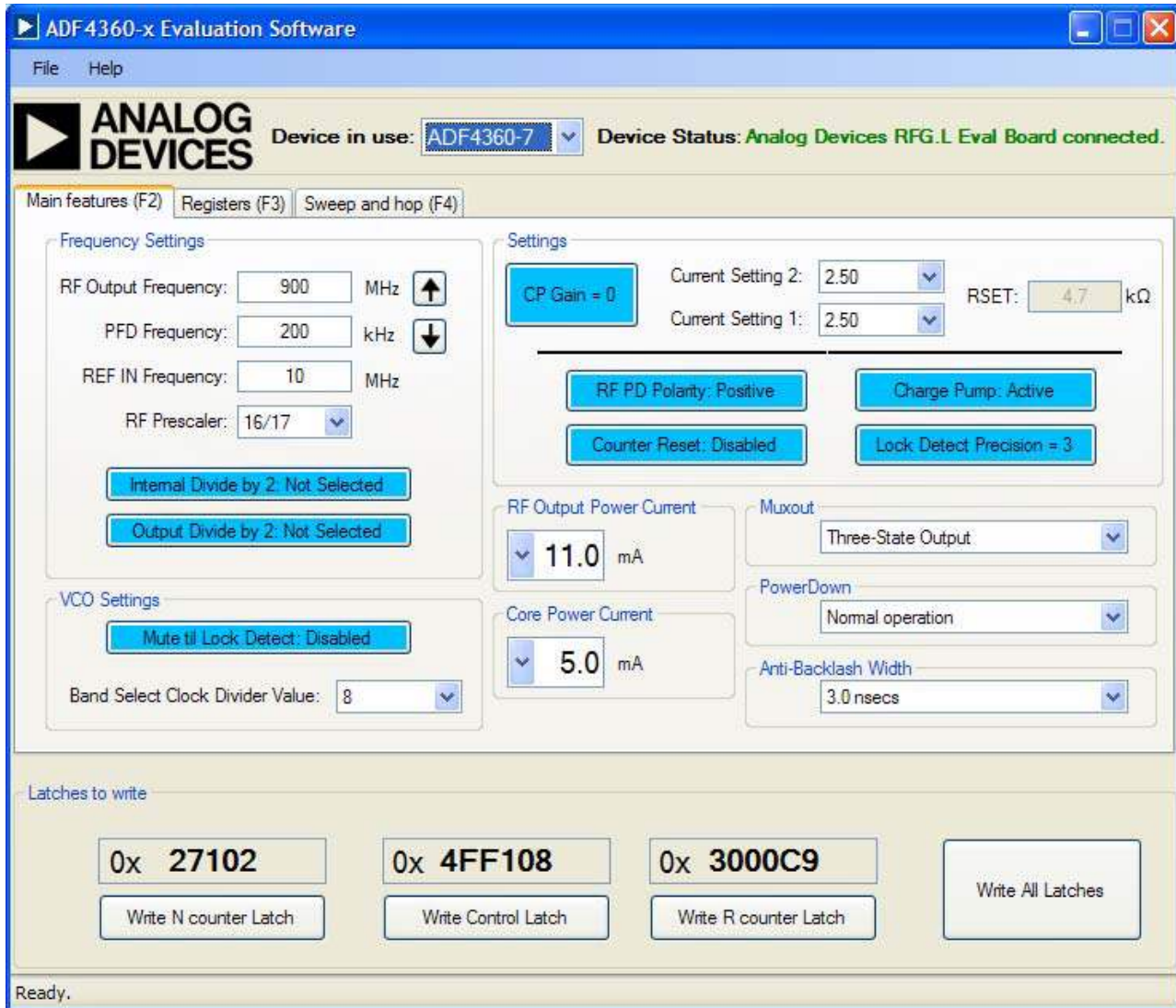


Figure 10. Software Front Panel Display

06891-010



EVALUATION BOARD SCHEMATIC

110-16880

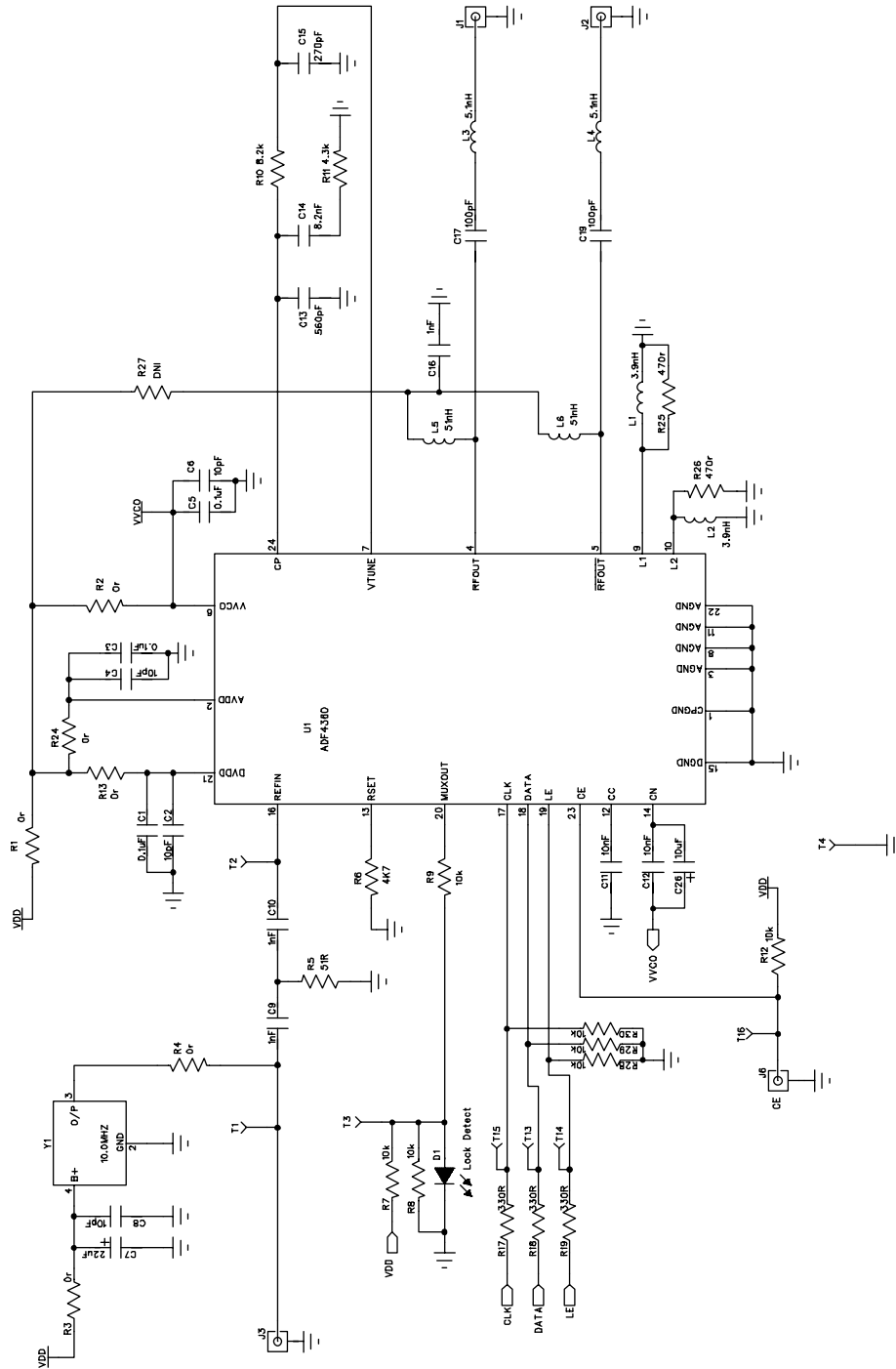


Figure 11. EV-ADF4360-7EB1Z Schematic





**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 $\mu$ F, 16 V                             | Kemet C0402C104K4RAC                           |
| C2, C4, C6, C8   | Capacitor, 0402, 10 pF, 50 V                                   | Kemet C0402C100J5GACTU                         |
| C7   | Capacitor, Case A, 22 $\mu$ F, 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  | Capacitor, loop filter, 0603, 560 pF, 50 V                     | AVX 2238 586 15619                             |
| C14  | Capacitor, loop filter, 0603, 8.2 nF, 50 V                     | AVX 2238 586 15635                             |
| C15  | Capacitor, loop filter, 0603, 270 pF, 50 V                     | AVX 2238 586 15615                             |
| C16  | Multilayer ceramic capacitor, 50 V, X7R, 1 nF, $\pm$ 10%, 0402 | Murata GRM155R71H102KA01D                      |
| C17, C19   | Capacitor, 0603, 100 pF, 50 V                                  | Phycomp 2238 867 15101                         |
| C18, C28   | Capacitor 0603, 1 $\mu$ F, 25 V                                | Taiyo Yuden TMK107BJ105KA-T                    |
| C20, C23   | Capacitor, Case A, 1 $\mu$ F, 16 V                             | AVX TAJA105K016R                               |
| C22, C25   | Capacitor, Case A, 4.7 $\mu$ F, 10 V                           | AVX TPSA475K010R1400                           |
| C26  | Capacitor, Case A, 10 $\mu$ F, 6.3 V                           | Kemet T491A106M016AT                           |
| C31, C33   | Capacitor, 0805, 10 $\mu$ F, 6.3 V                             | Murata GRM21BR71A106KE51L                      |
| C34  | Capacitor, 0402, 22 pF, 50 V NPO                               | Kemet C0402C220J5GACTU                         |
| C35, C36   | Capacitor 0402, 12 pF, 50 V                                    | 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                                |
| 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, 3.9 nH, 5%, 0402                        | Coilcraft 0402CS-3N9X_LU                       |
| L3, L4   | Ceramic chip inductor, 5.1 nH, 5%, 0603                        | Coilcraft 0603CS-5N1X_LU                       |
| L5, L6   | Ceramic chip inductor, 51 nH, 5%, 0603                         | Coilcraft 0805HQ-51NX_LB                       |
| 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, R13, R22 to R24, R27, R36, R38                     | Resistor, 0603, 0 $\Omega$                                     | Multicomp MC 0.063W 0603 0R                    |
| R5   | Resistor, 0603, 51 $\Omega$                                    | Multicomp MC 0.063W 0603 1% 51R                |
| R6, R15  | Resistor, 0603, 4.7 k $\Omega$                                 | Multicomp MC 0.063W 0603 1% 4K7                |
| R7, R8, R12, R28, R29, R30                                   | Resistor, 0603, 10 k $\Omega$                                  | Multicomp MC 0.063W 0603 1% 10K                |
| R9   | Resistor, 0603, 100 $\Omega$                                   | Multicomp MC 0.063W 0603 1% 100R               |
| R10  | Resistor, loop filter, 0805, 8.2 k $\Omega$                    | Multicomp MC 0.1W 0805 1% 8K2                  |
| R11  | Resistor, loop filter, 0805, 4.3 k $\Omega$                    | Multicomp MC 0.1W 0805 1% 4K3                  |
| R14, R16   | Resistor, 0603, 330 k $\Omega$                                 | Multicomp MC 0.063W 0603 1% 330K               |
| R17 to R19   | Resistor, 0603, 330 $\Omega$                                   | Multicomp MC 0.063W 0603 1% 330R               |
| R20, R21   | Resistor, 0603, 2.2 k $\Omega$                                 | Multicomp MC 0.063W 0603 1% 2K2                |
| R25, R26   | Resistor, 0603, 470 $\Omega$                                   | Multicomp MC 0.063W 0603 1% 470R               |
| R31, R32   | Resistor, 0603, 100 k $\Omega$                                 | Multicomp MC 0.063W 0603 1% 100K               |
| R34  | Resistor, 0603, 140 k $\Omega$                                 | Multicomp MC 0.063W 0603 1% 140K               |
| R35  | Resistor, 0603, 78.7 k $\Omega$                                | Multicomp MC 0.063W 0603 1% 78K7               |

| 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)                      |                                   |
| U1                   | Integrated integer-N synthesizer               | Analog Devices, ADF4360-7BCPZ     |
| U2                   | High accuracy low dropout linear 5 V regulator | Analog Devices, ADP3300ARTZ-3     |
| 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         |
| Y1                   | 10 MHz TCXO (FOX801)                           | Fox Electronics FOX801-BELF       |

**NOTES**

**NOTES**

## 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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