**Evaluating the ADATE302-02 500 MHz Dual Integrated DCL with Differential Drive/Receive, Level Setting DACs, and Per Pin PMU**

## FEATURES

- Full featured evaluation board for the ADATE302-02
- Supply voltages: +21 V and −10 V, on-board voltage regulators
- Breakout signal inputs and outputs through SMA connectors
- Differential pairs provided with 50 Ω controlled impedance traces with equal lengths
- LED indicators for read and write data
- PC software for control through USB

## EVALUATION KIT CONTENTS

- EV-ADATE302-02EBZ

## EQUIPMENT NEEDED

- PC running Windows
- Type A to Type B USB cable (at least USB 2.0)
- Benchtop power supplies and connector cables
- Data timing generator (DTG) or equivalent
- Oscilloscope

## ONLINE RESOURCES

- ADATE302-02 data sheet
- Bill of Materials
- ADATE302-02 Evaluation Software

## GENERAL DESCRIPTION

The EV-ADATE302-02EBZ is a full featured evaluation board designed to allow simple evaluation of all features of the ADATE302-02 dual-integrated driver, comparator, and active load (DCL) and four-quadrant per pin parametric measurement unit (PPMU). The EV-ADATE302-02EBZ features breakout connections through the Subminiature Version A (SMA) terminals for all the signal inputs and outputs. The differential pairs are provided with 50 Ω controlled impedance traces with equal lengths.

The EV-ADATE302-02EBZ only requires two power supplies, +21 V and −10 V. All other voltages required by the device are created by the on-board regulators. The EV-ADATE302-02EBZ serial peripheral interface (SPI) communications are provided by an on-board USB universal asynchronous receiver transmitter (UART) chip. SPI jumper connectors allow users to bypass the UART and connect their own SPI signals for evaluation (see Table 1). The default setup is for control through the USB port. Communication with the ADATE302-02 evaluation board software is through the USB, and the light emitting diode (LED) indicators on the EV-ADATE302-02EBZ provide displays for the read and write data.

The ADATE302-02 data sheet provides full details on all the features of the ADATE302-02 device, as well as the information on each of the registers within the ADATE302-02, and must be consulted when using the EV-ADATE302-02EBZ evaluation board.

## TABLE OF CONTENTS



## REVISION HISTORY

**11/2023—Revision 0: Initial Version**

## EVALUATION BOARD PHOTOGRAPH

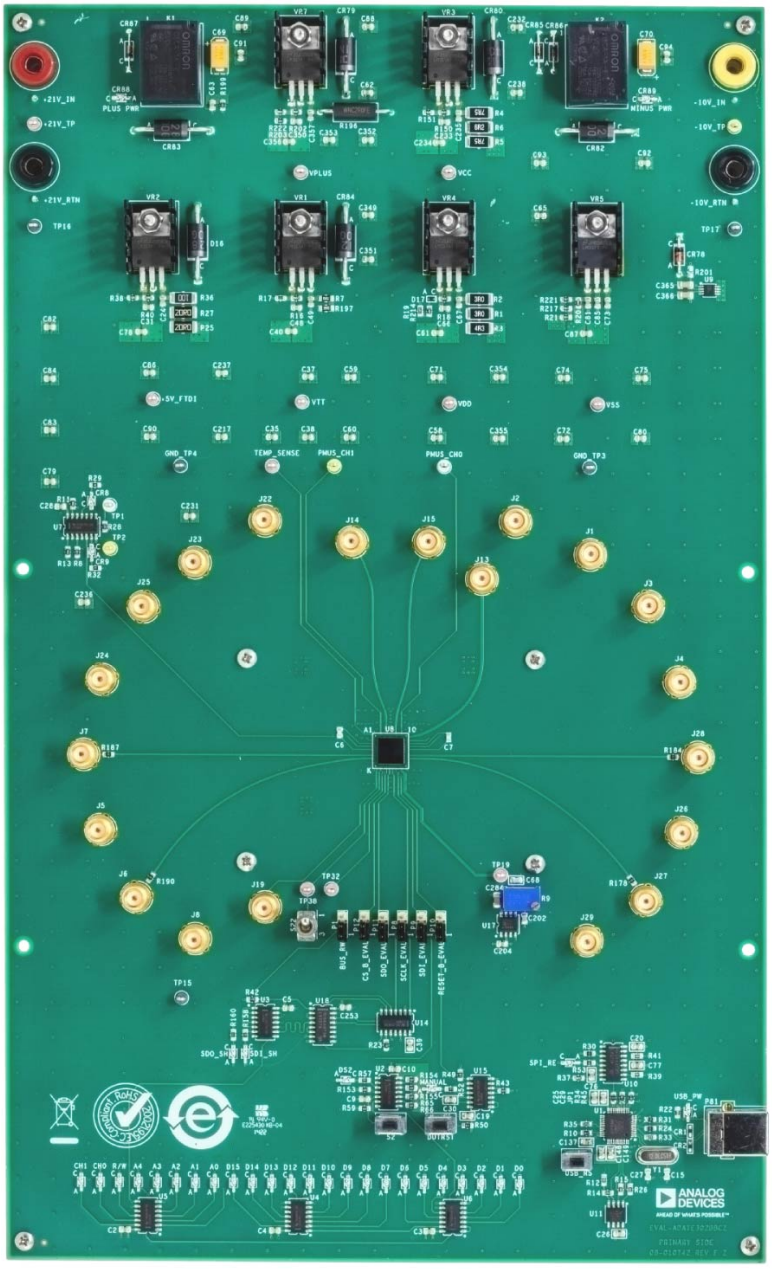



*Figure 1. EV-ADATE302-02EBZ*

## QUICK START GUIDE

To run the EV-ADATE302-02EBZ with the ADATE302-02 for the first time, take the following steps:

1. Install the **ADATE302-02 Evaluation Board Software**. Note that the evaluation software must be installed before connecting the EV-ADATE302-02EBZ or the USB communications may not function properly. To install the required USB drivers and software to the PC, download the ADATE302-02 Evaluation Board Software and run the **adate302-02install.exe** file. By default, all software, documentation, and setup files copy to **C:\ProgramData\Microsoft\Windows\Start Menu\Programs\ADATE302-02 Evaluation Board Software**.
2. Restart the PC.
3. Plug in the hardware.
   a. Turn the following power supplies on:
      - 21 V DC = 21 V
      - −10 V DC = −10 V
      - GND = 0 V
   b. Using the USB cable, connect the EV-ADATE302-02EBZ to the PC. Most Windows® PCs automatically install the USB drivers the first time a powered FTDI chip is connected through the USB. However, the user can retrieve the drivers from the FTDI D2xx direct drivers page, if required.
   c. The **FTD2XX.dll** can also be found in **C:\Program Files (x86)\ADATE302-02 Evaluation Board Software\Dac**.
4. Open the **ADATE302-02 Evaluation Board Software** using one of the following options:
   - Select the **ADATE302-02 Evaluation Board Software** in the Windows **Start** menu (see Figure 2).

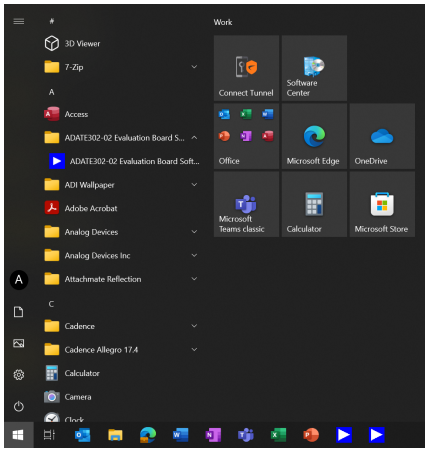



*Figure 2. ADATE302-02 Evaluation Board Software in the Windows Start Menu*

   - Search for the **ADATE302-02 Evaluation Board Software** using the Windows search feature, and then select the **ADATE302-02 Evaluation Board Software** in the **Results** pane (see Figure 3).

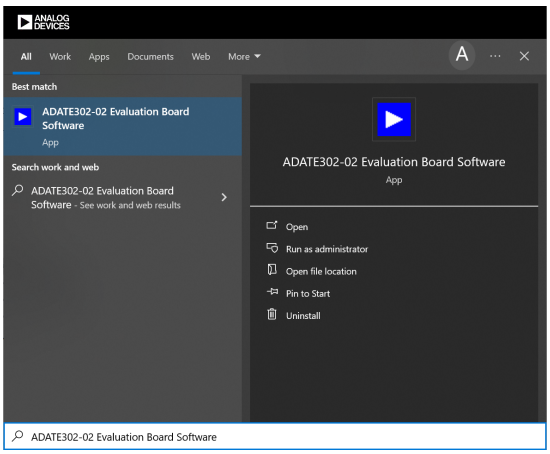



*Figure 3. Windows Search*

5. Verify that the PC is communicating with the hardware.
   a. When the **ADATE302-02 Evaluation Board Software** opens, the main window opens if there are no issues (see Figure 4) and displays configuration success (see Figure 8). Otherwise, a command prompt indicating any error appears. Figure 5 shows examples of error prompt. Follow all the recommendations within the prompt window before attempting to start the software again.

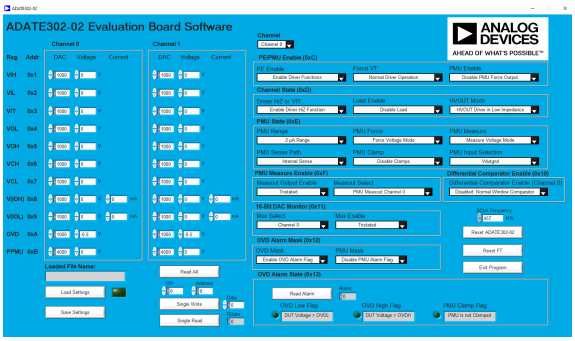
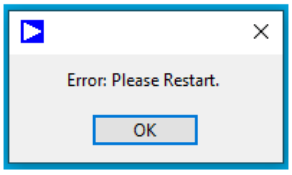



*Figure 4. ADATE302-02 Main Window*



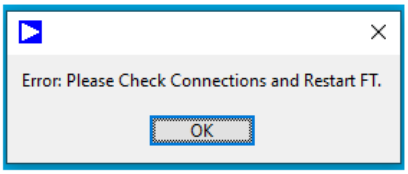




*Figure 5. Error Prompt Examples*

## QUICK START GUIDE

**b.** To improve the viewing experience of the software user interface, the user can set the custom scale size of the PC or laptop display by following these steps:

1. Open settings, and click **System**.
2. Go to **Display**.
3. In the **Scale and layout** section, choose the 100% scale setting by using the scale dropdown menu.
4. Restart the software to apply any changes. Note that Figure 6 is based on Windows 10.

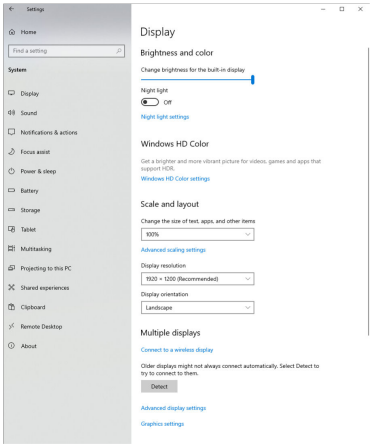



*Figure 6. Scale Setting*

**c.** To verify the hardware communication, load the **ADATE302-02 Default Test Conditions.sbus** file. If the EV-ADATE302-02EBZ successfully communicates with the PC, the software user interface (see Figure 7) reflects the default values (see the ADATE302-02 data sheet for more information). If the user interface does not reflect the default values, perform the following steps:

1. Close the **ADATE302-02 Evaluation Board Software**.
2. Disconnect the USB cable.
3. Turn off the power supply.
4. Activate the power supply again.
5. Reconnect the USB cable.
6. Open the **ADATE302-02 Evaluation Board Software**, the command prompt displays configuration success (see Figure 8). Then, load the ADATE302-02 **Default Test Conditions.sbus** file to confirm if the user interface reflects the default values of the registers (see Figure 7).

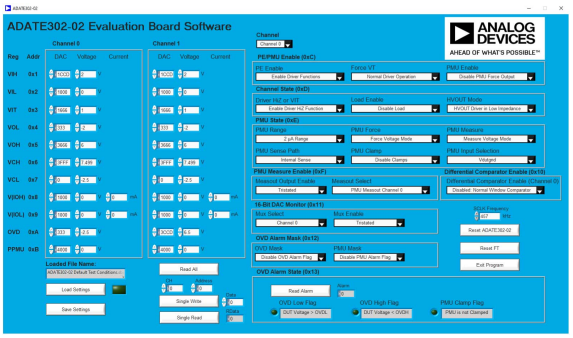



*Figure 7. User Interface Default Values*

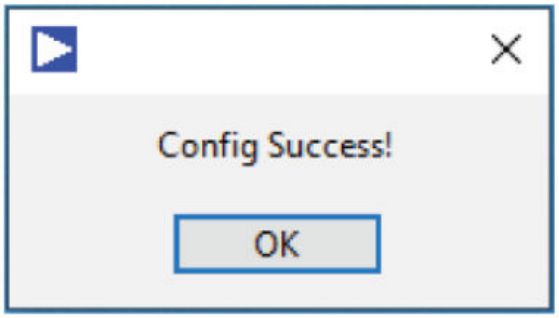



*Figure 8. Configuration Success Prompt*

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

Provide the following external power supplies:

- 21 V between 21 V DC and GND
- −10 V between −10 V DC and GND

The GND input is provided on the EV-ADATE302-02EBZ. Each device supply is decoupled to GND with a 10 µF and 0.1 µF capacitors. Each device supply pin is again decoupled with a 0.1 µF capacitor to GND (see the Evaluation Board Schematics and Artwork section for reference).

### DEFAULT JUMPER SETUP

Use the PC to control the default setup through the USB port. The default link options are listed in Table 1.

*Table 1. Default Jumper Setup*

| Jumper Name | Default | Function |
|---|---|---|
| P1 | Pin 1 to Pin 2 | Controls the multiplexers output for the read or write bit light-emitting diode (LED) display |
| P8 | Pin 1 to Pin 2 | SCLK source select, on-board (default) or external |
| P9 | Pin 1 to Pin 2 | SDI source select, on-board (default) or external |
| P10 | Pin 1 to Pin 2 | RSTB source select, on-board (default) or external |
| P11 | Pin 1 to Pin 2 | Connects the device SDO to on-board microcontroller |
| P12 | Pin 1 to Pin 2 | CSB source select, on-board (default) or external |

## EVALUATION BOARD HARDWARE

### USING THE EV-ADATE302-02EBZ

The EV-ADATE302-02EBZ requires two voltage supplies (+21 V and −10 V). The +21 V and −10 V supplies are enough to power the entire board including the digital portion. The evaluation board also has an SMA provision for both the inputs and outputs. The EV-ADATE302-02EBZ must be controlled through the USB and can be used with the provided software for easy access to user registers within the ADATE302-02. Designed to be interactive, the EV-ADATE302-02EBZ also features an LED array at the bottom portion to notify the user that the correct data is being written to or read from the device.

### EV-ADATE302-02EBZ NOTES

When using the EV-ADATE302-02EBZ, take note of the following:

- R9, the blue trimmer resistor located near the middle of the EV-ADATE302-02EBZ, is used to adjust the 5 V reference to the device under test (DUT).
- The 5 V reference can be monitored on TP19, which is nearby, while adjusting R9. This reference is set; however, it can be adjusted if required.

*Table 2. Power Supply Voltage Levels*

| Power Supply | Voltage (V) |
|---|---|
| VPLUS | 16.75 |
| VDD | 10.00 |
| VCC | 3.30 |
| VTT | 1.50 |
| VSS | −5.75 |

- Near TP15 and the U3 IC are two LEDs. When activated, SDI_SH LED indicates a serial data bus write to the ADATE302-02, and the serial bus LED field reflects the data written out. Conversely, the SDO_SH LED, when activated, indicates a serial bus read from the ADATE302-02 and that the EV-ADATE302-02EBZ serial bus LED bank is reading from the DUT.
- The SDO_SH LED and serial bus LEDs do not reflect the whole SPI read word due to limits on the hardware circuitry or software programming. Disregard LEDs CH1 to A0 when reading.
- The device and FTDI microcontroller connection can be reset manually by pressing DUTRST and USB_RS, respectively.
- Handle with care and operate only if there are standoffs connected.

## EVALUATION BOARD SOFTWARE

### SOFTWARE OPERATION

The **ADATE302-02 Evaluation Board Software** provides a graphical user interface (GUI) to control the ADATE302-02 serial bus. The serial bus provides control for the internal digital-to-analog converter (DAC) levels and modes of operation of the device, as described in the ADATE302-02 data sheet. Windows 7 SP1 is required at a minimum. No Mac version is currently available.

To start the **ADATE302-02 Evaluation Board Software**, take the following steps:

1. Use the Windows search feature to find the **ADATE302-02 Evaluation Board Software**.
2. When the search displays the **ADATE302-02 Evaluation Board Software**, select it. The main **ADATE302-02 Evaluation Board Software** window opens as shown in Figure 4. Load the **ADATE302-02_default.sbus** file after startup.

The main **ADATE302-02 Evaluation Board Software** window provides controls for the main functions of the ADATE302-02, including access to the DAC registers. The main window of the **ADATE302-02 Evaluation Board Software** also includes the following panels:

- The ADATE302-02 DAC levels panel allows the user to write to the DACs within the ADATE302-02.
- The single read and write panel allows the user to write single word commands and single register readbacks to or from the ADATE302-02 if so desired.
- The mode selection controls panel located on the right side of the GUI (see Figure 12), allows the user to configure the settings of the ADATE302-02.
- The **Reset FT** and clock speed controls are located in the lower right of the GUI (see Figure 4).

### DAC LEVELS

The ADATE302-02 DAC levels panel, located in the upper-left corner of the GUI, lists all the current settings of the DACs within the ADATE302-02 (see Figure 9). Each channel has their individual registers, which means each register can be edited individually. The **Single Write** button in Figure 10 can be used to write on both channels at the same time. **DAC** values in the DAC levels panel can also be changed in real time by clicking on the up-down arrows in the corresponding box. If a **Voltage** value is selected with the cursor and a value typed into the window, it is changed when either the mouse is clicked on the entry value or the enter key on the keyboard is pressed. Note that the **DAC** levels or **Voltage** is limited to the numbers stated in the ADATE302-02 data sheet. Note that typing a greater or lesser value than the maximum or minimum value prompts the software to write the maximum or minimum value instead. This same result is true for **Address**, **CH**, and **Data** as well on single writes or reads. Either the **DAC** levels or **Voltage** can be changed, and the others change accordingly.

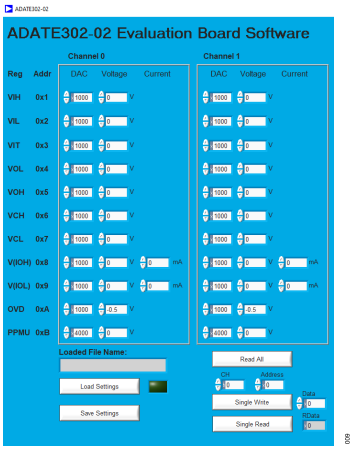



*Figure 9. ADATE302-02 DAC Levels Panel*

### LOAD FILE SETTINGS

Click the **Load Settings** and **Save Settings** buttons to load or save register settings for all DAC and control registers, respectively, for quicker testing (see Figure 10).

The **Load Settings** button prompts the user to choose a previously created setup file. The file updates the GUI and writes changed values out to the ADATE302-02. Click **Save Settings** to save all DAC level values and mode controls. Note that the user is prompted to provide a file name under which all settings are saved.

In the lower left section, click **Single Write** to write the data-word shown in the controls (**CH**, **Address**, or **Data**) to the serial bus of the ADATE302-02. The values of the controls can be manually changed by placing the cursor in the box and entering the desired value. The **Address** and **Data** controls are in hex, while **CH** is in binary. Inputs on **CH** can be same with the binary stated on the ADATE302-02 data sheet. Changes made using **Single Write** updates the software corresponding to that change. All inputs made to the controls are written to the device when the **Single Write** button is clicked.

Click **Single Read** to read back the register that is addressed in its **Address** text box. The data is shown only in the **RData** indicator, and it is in hexadecimal format only.

Click **Read All** to read back the corresponding register value from the ADATE302-02 and displays it in the software. This button can be used to check if the chip and the software settings are in sync.


*Figure 10. Load Settings, Save Settings, Single Read, Single Write, and Read All*

## EVALUATION BOARD SOFTWARE

### SCLK FREQUENCY, RESET ADATE302-02, RESET FT, AND EXIT PROGRAM

In the lower right section, **SCLK Frequency** can be used to change the frequency of the SCLK. Only certain frequencies are allowed due to the limitations of the hardware. Thus, the nearest allowed frequency is used instead of the user input, unless the one input is allowed. To set the **SCLK Frequency**, press the enter key (on the keyboard) to apply the set value to the **SCLK Frequency** box.

The **Reset ADATE302-02** button resets the device and automatically reads the device. The connection between FTDI and the PC can also be reset through the **Reset FT** button. Closing the program by clicking **Exit Program** also resets the device.

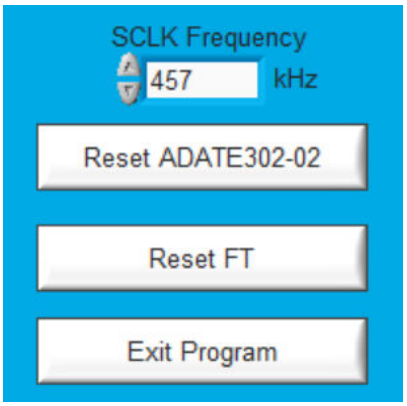



*Figure 11. SCLK Frequency, Reset ADATE302-02, Reset FT, Exit Program*

### MODE SELECTION CONTROLS

The mode selection controls panel allows the modification of the settings of the ADATE302-02 by letting the user know which register is being written to, and what specific setting is being changed (see Figure 12). Alarms can also be read from this panel. At the top left of the GUI, **Channel** is a dropdown menu that controls which channel the mode selection control section is sending commands to. **Single Write** must be used to write to both channels at the same time. The mode selection controls panel of the GUI places the DCL in its various states as described in the ADATE302-02 specification. See the ADATE302-02 data sheet for a detailed description of the registers.

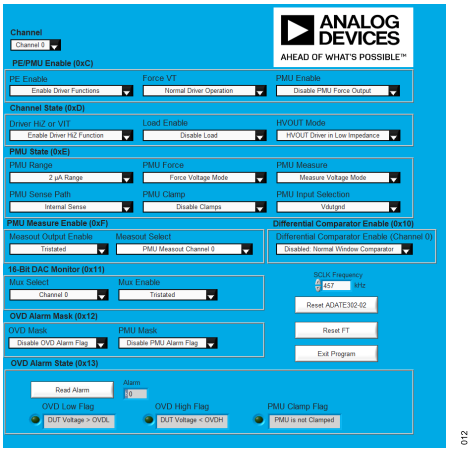



*Figure 12. Mode Selection Controls*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

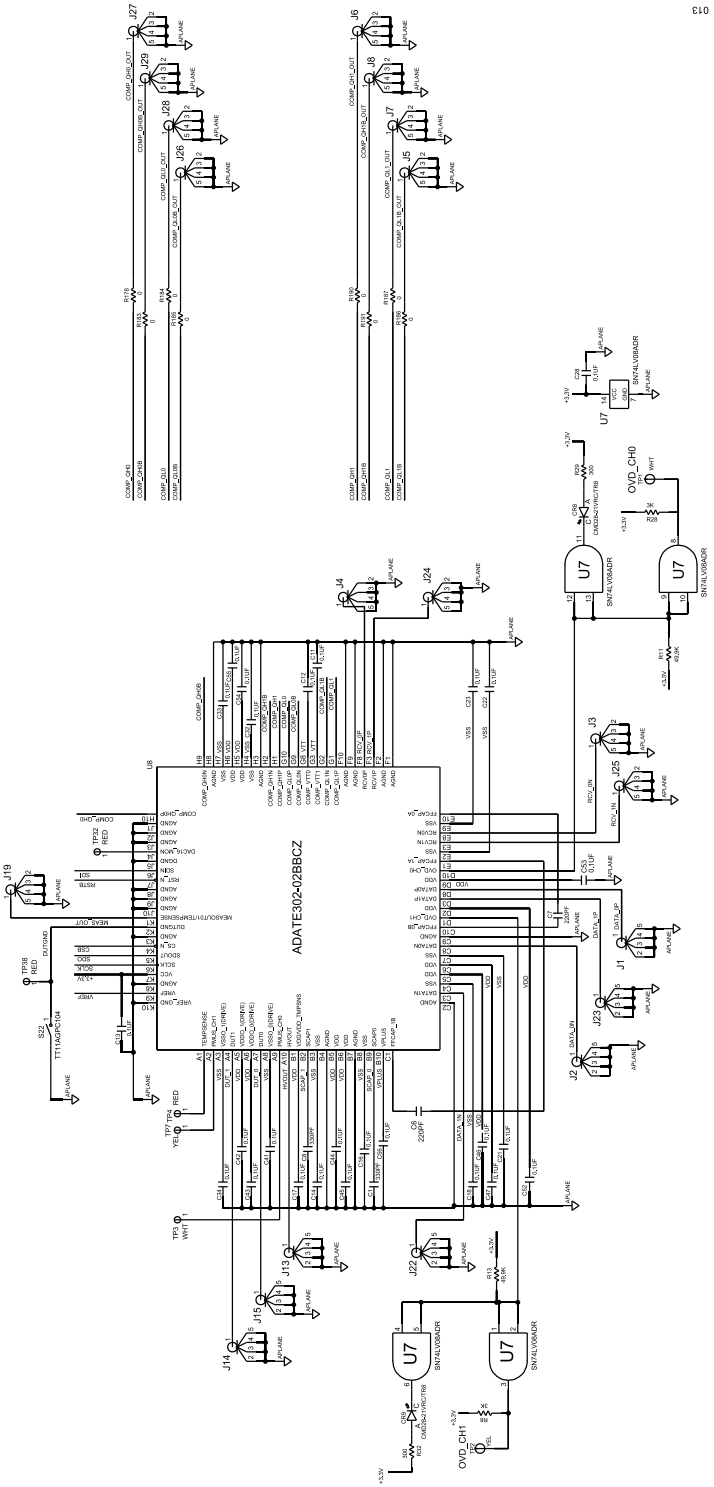



*Figure 13. EV-ADATE302-02EBZ Schematic, Page 1*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

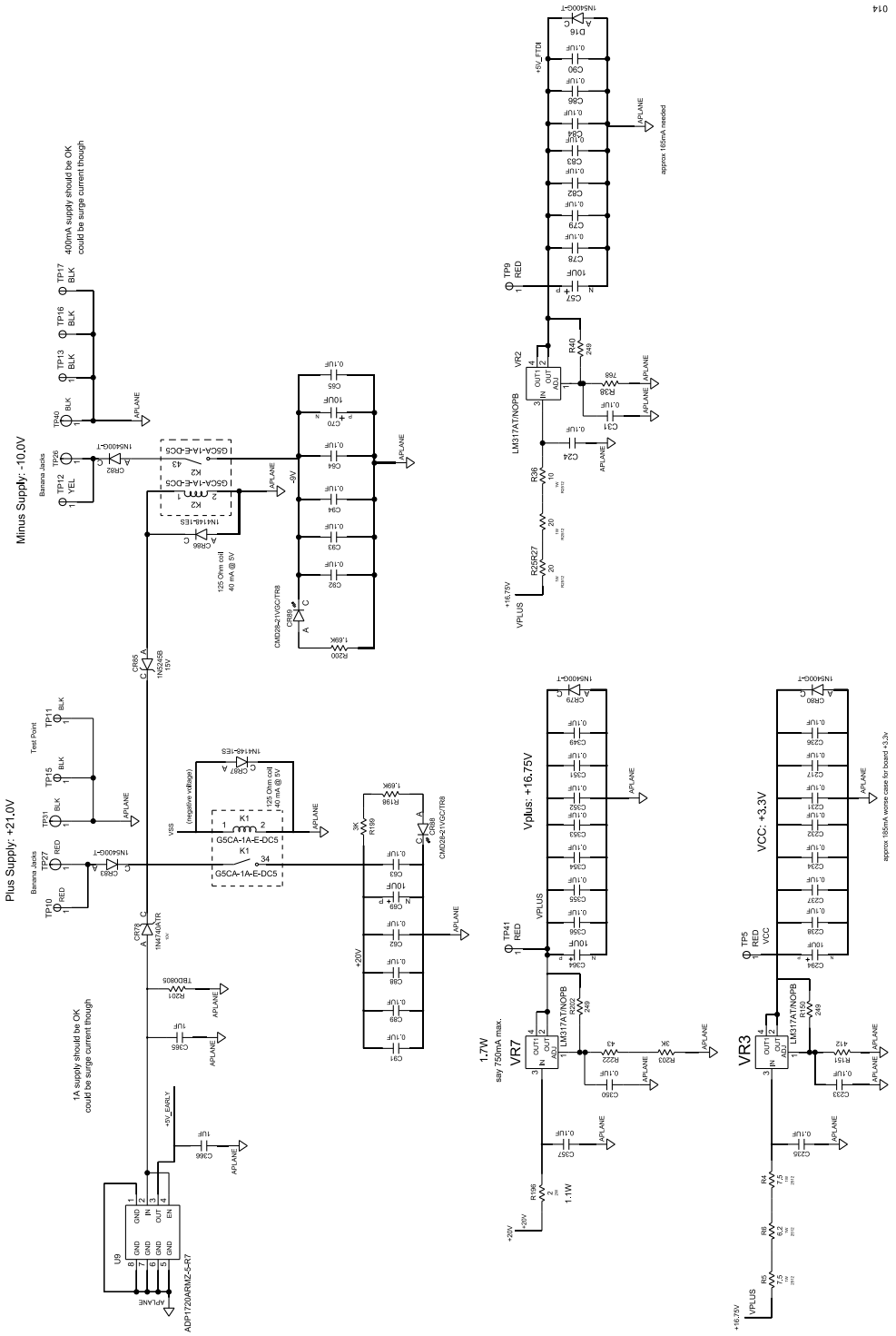



*Figure 14. EV-ADATE302-02EBZ Schematic, Page 2*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

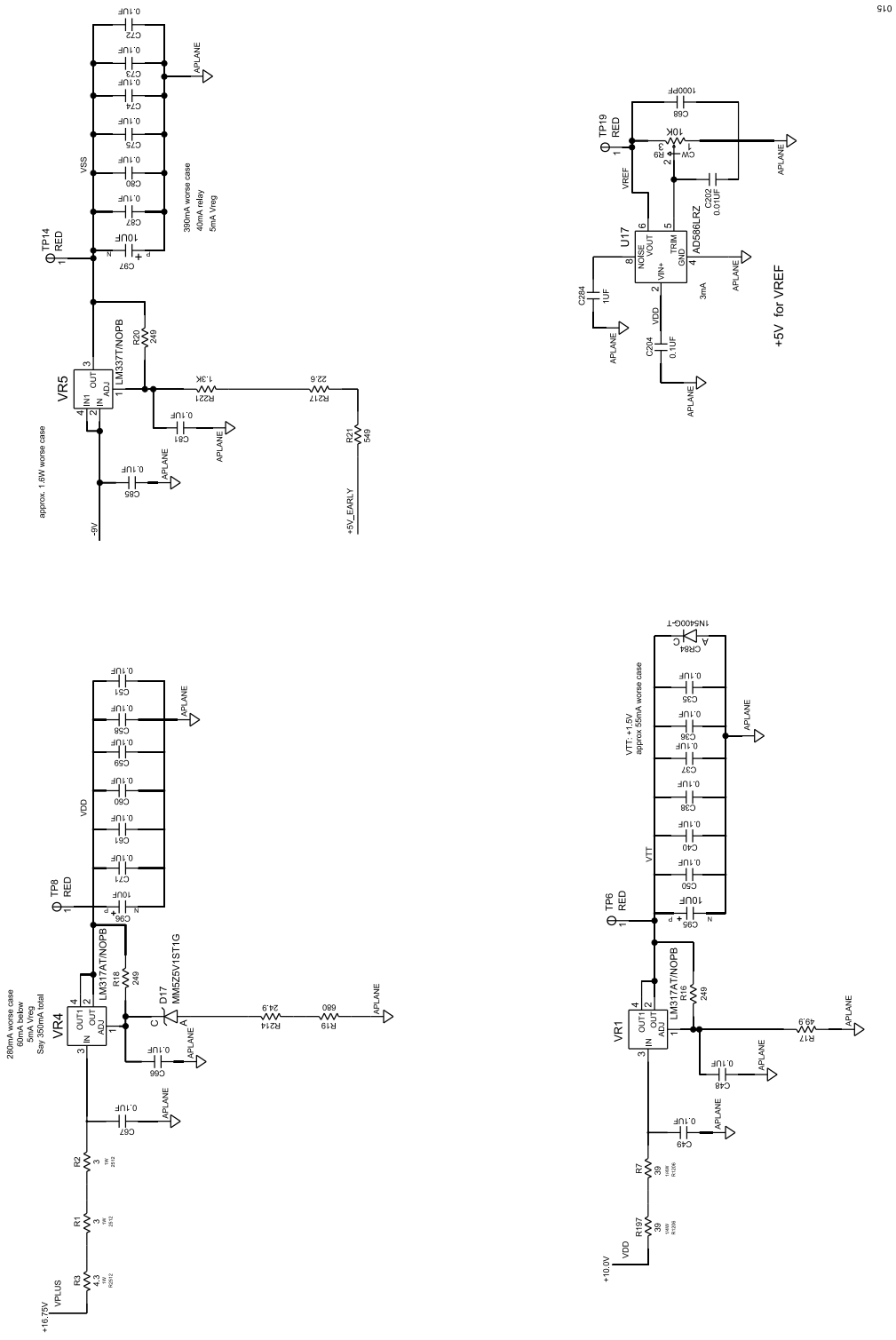



*Figure 15. EV-ADATE302-02EBZ Schematic, Page 3*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

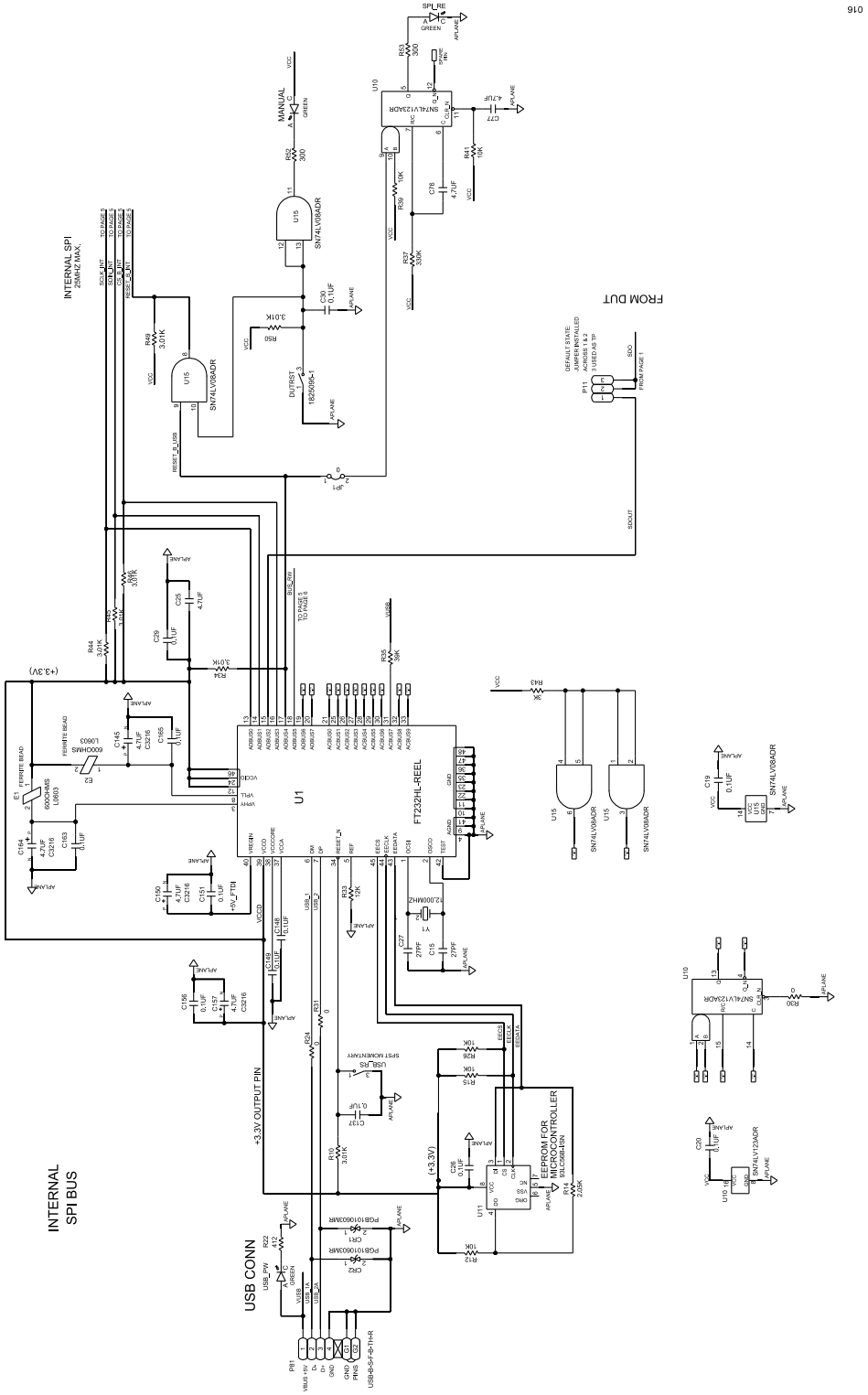



*Figure 16. EV-ADATE302-02EBZ Schematic, Page 4*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

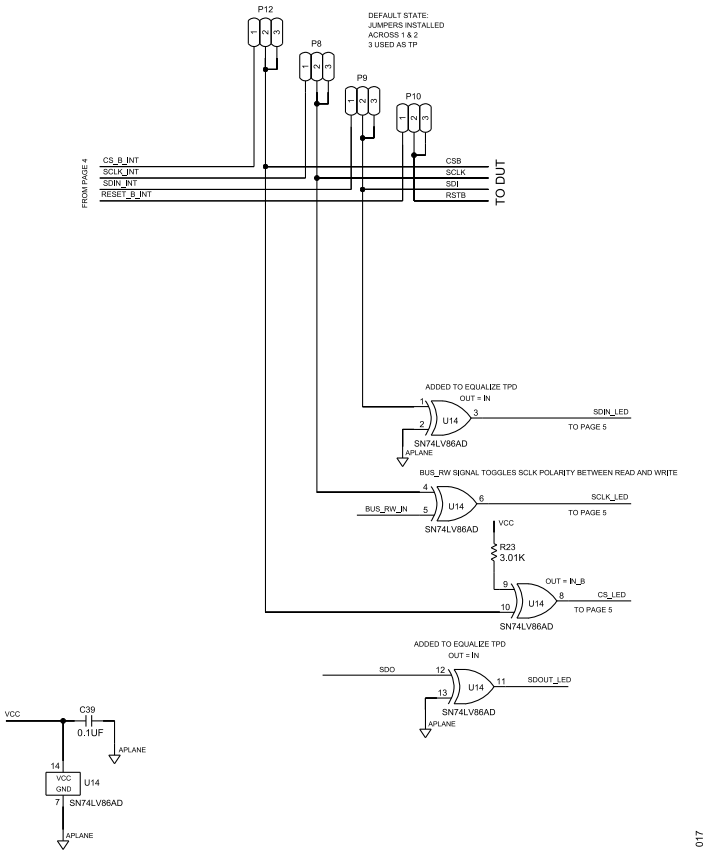



*Figure 17. EV-ADATE302-02EBZ Schematic, Page 5*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

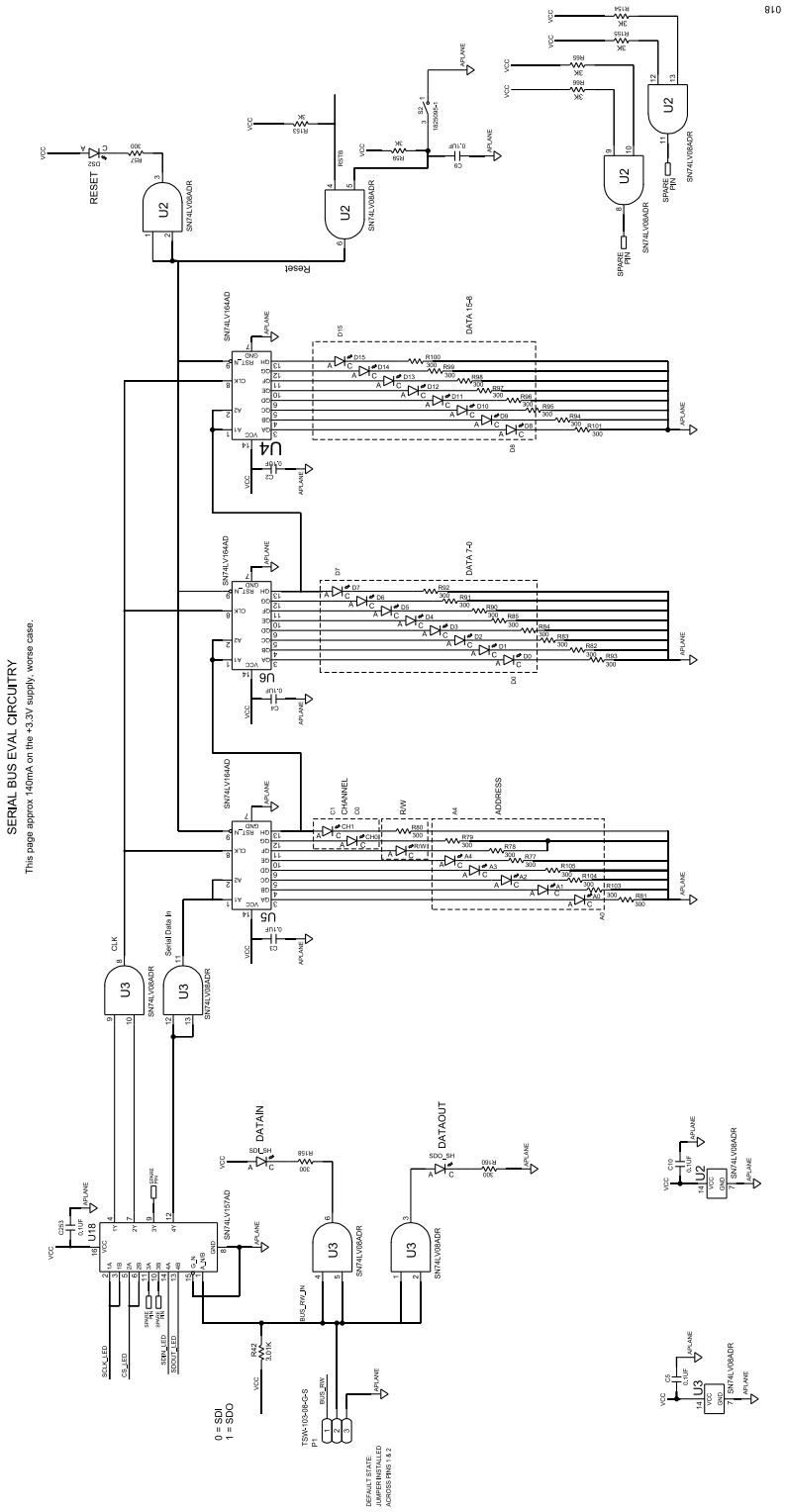



*Figure 18. EV-ADATE302-02EBZ Schematic, Page 6*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

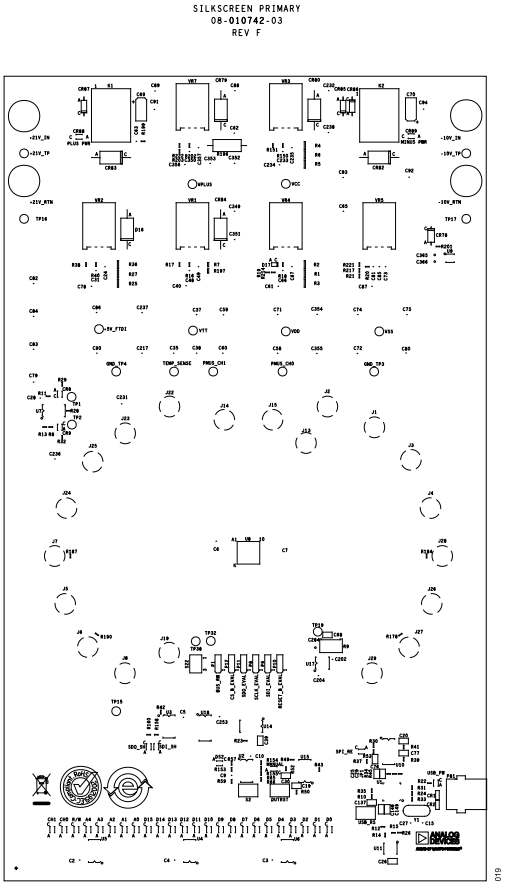



*Figure 19. EV-ADATE302-02EBZ Silkscreen, Primary*

## EVALUATION BOARD SCHEMATICS AND ARTWORK

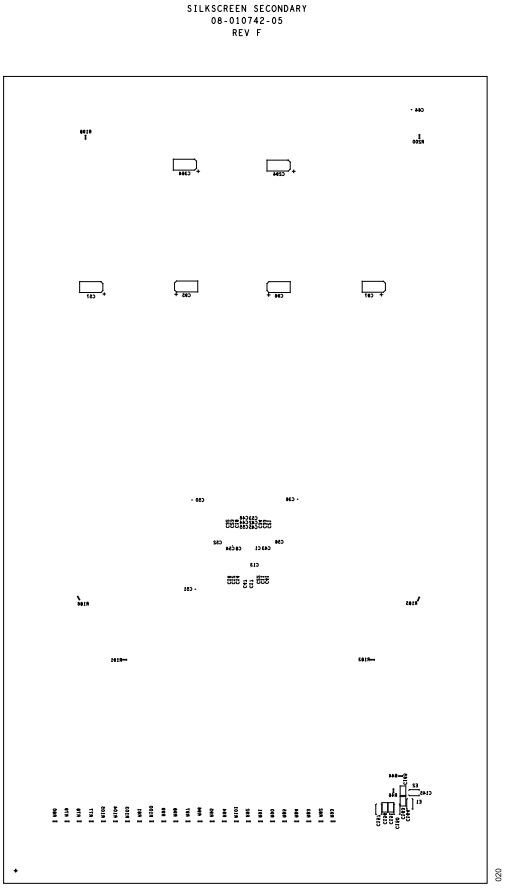



*Figure 20. EV-ADATE302-02EBZ Silkscreen, Secondary*

## 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.