Evaluating the ADATE304 200 MHz Dual Integrated DCL with Level Setting DACs, Per Pin PMU, and Per Chip VHH

FEATURES

- Full featured evaluation board for the ADATE304
- 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

- EVAL-ADATE304BBCZ

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

- Bill of Materials
- Documents Needed
  - ADATE304 data sheet
- Software Needed
  - ADATE304 Evaluation Software

GENERAL DESCRIPTION

The EVAL-ADATE304BBCZ is a full featured evaluation board designed to allow the user to simply evaluate all features of the ADATE304 dual integrated driver, comparator, and active load (DCL) and four-quadrant per pin parametric measurement unit (PPMU). The EVAL-ADATE304BBCZ features breakout connections through the SMA terminals for all the signal inputs and outputs. The differential pairs are provided with 50 Ω controlled impedance traces with equal lengths.

The EVAL-ADATE304BBCZ 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 EVAL-ADATE304BBCZ SPI communications are provided by an on-board USB UART chip. SPI jumper connectors allow the user 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 ADATE304 evaluation board software is through the USB, and the light emitting diode (LED) indicators on the EVAL-ADATE304BBCZ provide displays for the read and write data.

The ADATE304 data sheet provides full details on all the functionalities of the ADATE304 device, as well as the information on each of the registers within the ADATE304, and must be consulted when using the EVAL-ADATE304BBCZ.

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REVISION HISTORY

8/2023—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

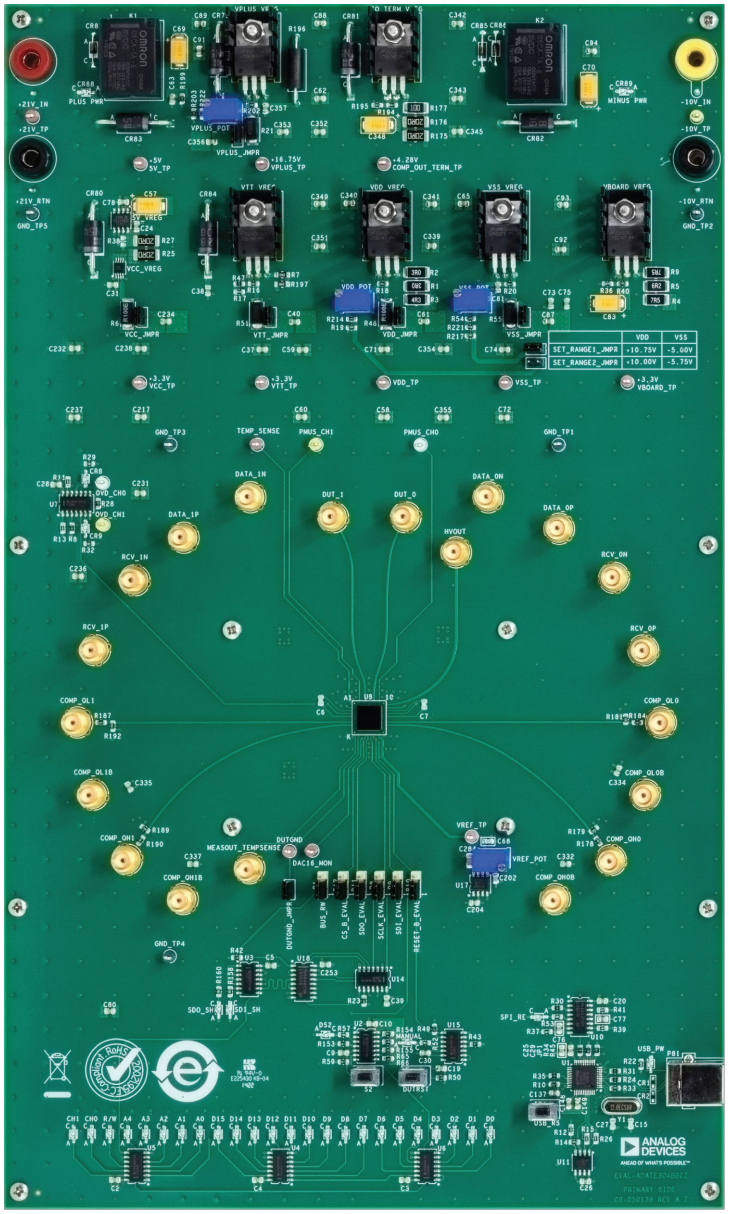


Figure 1. EVAL-ADATE304BBCZ

QUICK START GUIDE

To run the EVAL-ADATE304BBCZ with the ADATE304 for the first time, take the following steps:

1. Install the software. Note that the evaluation software must be installed before connecting the EVAL-ADATE304BBCZ, or the USB communications may not function properly. To install the required USB drivers and software to the PC, download the ADATE304 Evaluation Software and run the **adate304install.exe** file. By default, all software, documentation, and setup files copy to **C:\ProgramData\Microsoft\Windows\Start Menu\Programs\ADATE304 Evaluation Board Software**.
2. Restart the computer.
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 EVAL-ADATE304BBCZ to the PC. Most Windows computers 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)\ADATE304 Evaluation Board Software\Dac**.
4. Open the ADATE304 evaluation software using one of the following options:
   - Select the **ADATE304 Evaluation Board Software** in the Windows **Start** menu (see Figure 2).

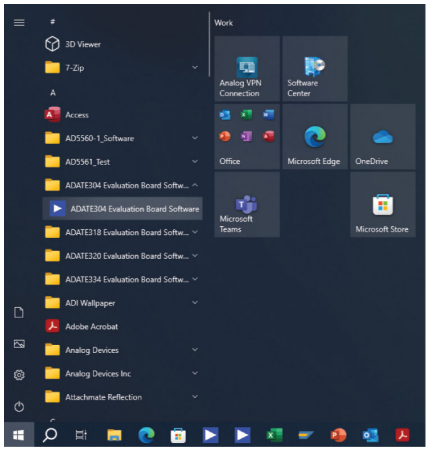


Figure 2. ADATE304 Evaluation Board Software in Start Menu

   - Search for the **ADATE304 Evaluation Board Software** using the Windows search feature, and then select the **ADATE304 Evaluation Board Software** in the results pane (see Figure 3).

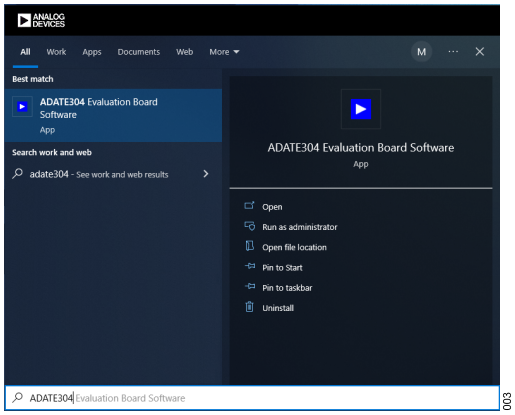


Figure 3. Windows Search

5. Verify that the PC is communicating with the hardware.
   a. When the **ADATE304 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 an examples of error prompt. Follow all the recommendations within the prompt window before attempting to start the software again.

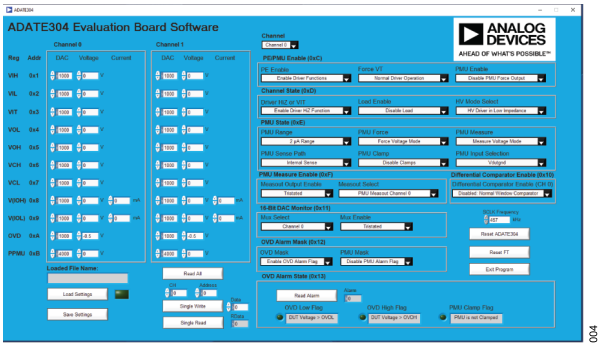
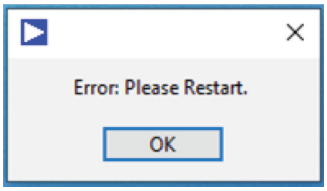


Figure 4. ADATE304 Main Window



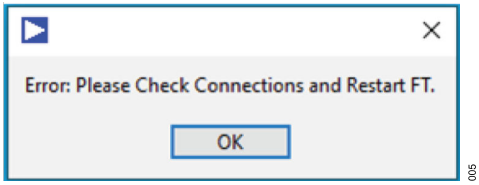


Figure 5. Error Prompt Examples

QUICK START GUIDE

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

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

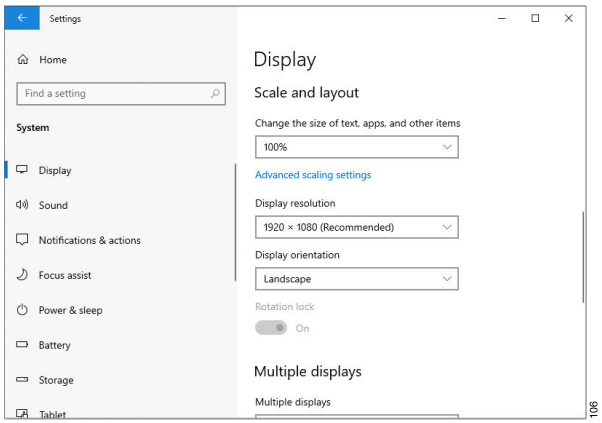


Figure 6. Scale Setting

c. To verify the hardware communication, load the **ADATE304 Default Test Conditions.sbus** file. If the EVAL-ADATE304BBCZ successfully communicates with the PC, the software user interface (see Figure 7) reflects the default values (see the ADATE304 data sheet for more information). If the user interface does not reflect the default values, perform the following steps:

1. Close the **ADATE304 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 **ADATE304 Evaluation Board Software**, the command prompt displays configuration success (see Figure 8). Then, load the ADATE304 **Default Test Conditions.sbus** file to confirm if the user interface reflects the default values of the registers (see Figure 7).

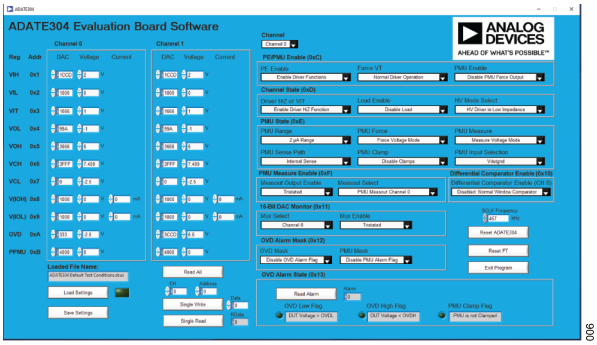


Figure 7. User Interface Default Values

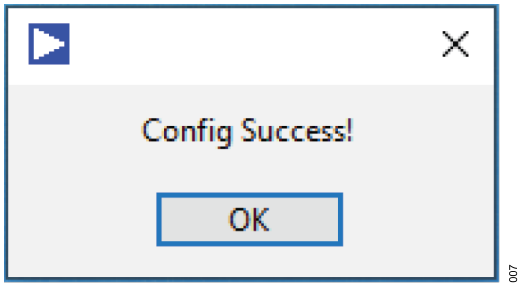


Figure 8. Configuration Success Prompt

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 EVAL-ADATE304BBCZ. Each device supply is decoupled to GND with a 10 µF and 0.1 µF capacitor. 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

The default setup is for control by the PC through the USB port. The default link options are listed in Table 1.

Table 1. Default Jumper Setup

Jumper Name	Default	Function
VPLUS_ JMPR	Inserted	Current measurement terminal for VPLUS (0.1 Ω sense resistor)
VCC_JMPR	Inserted	Current measurement terminal for VCC (0.1 Ω sense resistor)
VDD_JMPR	Inserted	Current measurement terminal for VDD (0.1 Ω sense resistor)
VSS_JMPR	Inserted	Current measurement terminal for VSS (0.1 Ω sense resistor)
SET_RANGE1_JMPR	Inserted	Sets the power supply range to Range 1
VTT_JMPR	Inserted	Current measurement terminal for VTT (0.1 Ω sense resistor)
DUTGND_JMPR	Inserted	Connects the device DUTGND to AGND plane
P1	Pin 1 to Pin 2	Controls the multiplexers output for read or write bit 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	$\overline{\text{RST}}$ 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	$\overline{\text{CS}}$ source select, on-board (default) or external

EVALUATION BOARD HARDWARE

USING THE EVAL-ADATE304BBCZ

The EVAL-ADATE304BBCZ 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 EVAL-ADATE304BBCZ must be controlled through the USB and can be used with the provided software for easy access to user registers within the ADATE304. Designed to be interactive, the EVAL-ADATE304BBCZ 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.

ADATE304 EVALUATION BOARD NOTES

When using the EVAL-ADATE304BBCZ, the following are some important information to take note:

- VREF_POT, the blue trimmer resistor located near the middle of the EVAL-ADATE304BBCZ evaluation board, is used to adjust the 5 V reference to the DUT.
- The 5 V reference can be monitored on VREF_TP, which is nearby, while adjusting VREF_POT. It has been set but can be adjusted if desired.
- Adjusting VPLUS, VDD, and VSS supplies between the two power supply ranges requires the use of VPLUS_POT, VDD_POT, and VSS_POT. The values of power supply with respect to the range used are listed in Table 2. SET_RANGE1_JMPR is inserted by default.

Table 2. Power Supply Ranges

Power Supply	Range 1	Range 2
VPLUS	16.75 V	16.75 V
VDD	10.75 V	10.00 V
VCC	3.30 V	3.30 V
VTT	3.30 V	3.30 V
VSS	−5.00 V	−5.75 V

- Place jumpers on VPLUS_JMPR, VCC_JMPR, VTT_JMPR, VDD_JMPR, and VSS_JMPR during normal operation. These terminals are also used to check the current flowing through the supply.
- Near GND_TP4 and the U3 IC are two LEDs. When activated, SDI_SH LED indicates a serial data bus write to the ADATE304, 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 ADATE304 and that the EVAL-ADATE304BBCZ 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 LED 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 software provides a graphical user interface to control the ADATE304 serial bus. The serial bus provides control for the internal DAC levels and modes of operation of the device, as described in the ADATE304 data sheet. Windows 7 SP1 is required at a minimum. No Mac version is currently available.

To start the **ADATE304 Evaluation Board Software**, follow these steps:

1. Use the Windows search feature to find the **ADATE304 Evaluation Board Software**.
2. When the search displays the **ADATE304 Evaluation Board Software**, select it. The main **ADATE304 Evaluation Board Software** window opens as shown in Figure 4. Load the **adate304_default.sbus** file after startup.

The main **ADATE304 Evaluation Board Software** window provides controls for the main functions of the ADATE304, including access to the DAC registers. The main window of the **ADATE304 Evaluation Board Software** also includes the following panels:

- The ADATE304 DAC levels panel allows the user to write to the DACs within the ADATE304.
- The single read and write panel allows the user to write single word commands and single register readbacks to or from the ADATE304 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 ADATE304.
- The FT reset and clock speed controls are located in the lower right of the GUI (see Figure 4).

DAC LEVELS

The ADATE304 DAC levels panel, located in the upper-left corner of the user interface, lists all the current settings of the DACs within the ADATE304 (see Figure 9). Each channel has their individual registers, which means each register can be edited individually. **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 data sheet. Typing a greater or lesser value than the maximum or minimum value prompts the software to write the maximum or minimum value instead. This is true for **Address**, **CH**, and **Data** as well on single writes/reads. Either the **DAC** levels or **Voltage** can be changed and the other changes accordingly.

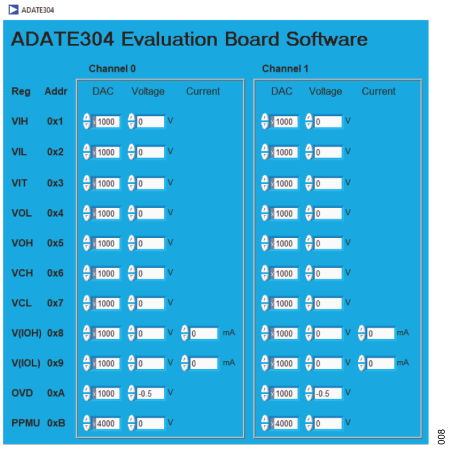


Figure 9. ADATE304 DAC Levels Panel

LOAD FILE SETTINGS

The **Load Settings and Save Settings** panel allows the user to load or save register settings for all DAC and control registers for quicker testing, by clicking the **Load Settings** button or the **Save Settings** button (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 ADATE304. All DAC Level values and all mode controls can be saved by clicking the **Save Settings** button. The user is prompted to provide a file name under which all the settings are saved.

In the lower left section, clicking on the **Single Write** button writes the data-word shown in the controls (**CH**, **Address**, **Data**) to the serial bus of ADATE304. The values of the controls can be manually changed by placing the cursor in the box and clicking 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 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.

The **Single Read** button reads 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.

The **Read All** button reads back the corresponding register value from the ADATE304 and displays it in the software. This button can be used to check if the chip and the software settings are in sync.

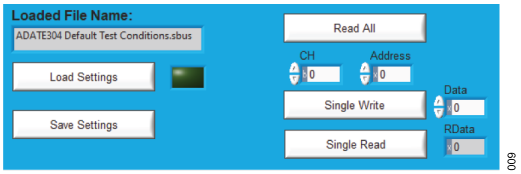


Figure 10. Load Settings, Save Settings, Single Read, Single Write, and Read All

EVALUATION BOARD SOFTWARE

SCLK FREQUENCY, RESET ADATE304, RESET FT, 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 ADATE304** button resets the device and automatically reads the device. The connection between FTDI and PC can also be reset through the **Reset FT** button. Closing the program through **Exit Program** also resets the device.

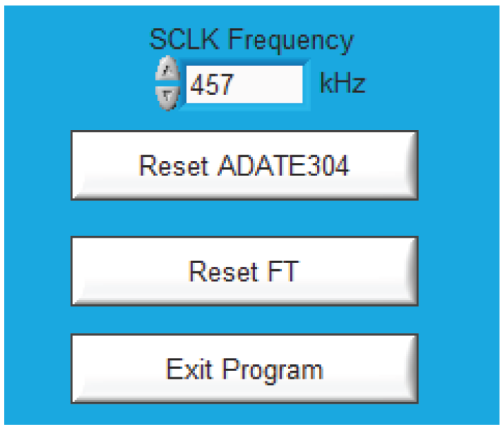


Figure 11. SCLK Frequency, Reset ADATE304, Reset FT, Exit Program

MODE SELECTION CONTROLS

The mode selection controls panel allows the modification of the settings of the ADATE304 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 drop-down box 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 ADATE304 specification. See the ADATE304 data sheet for a detailed description of the registers.

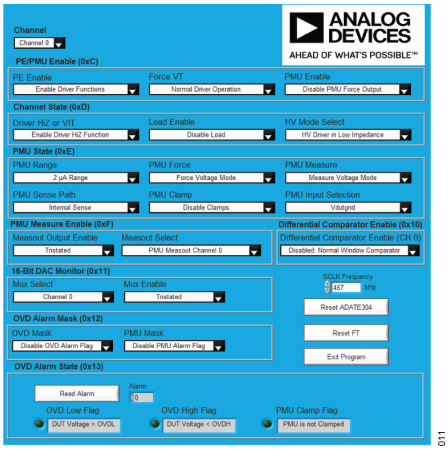


Figure 12. Mode Selection Controls Panel

EVALUATION BOARD SCHEMATICS AND ARTWORK

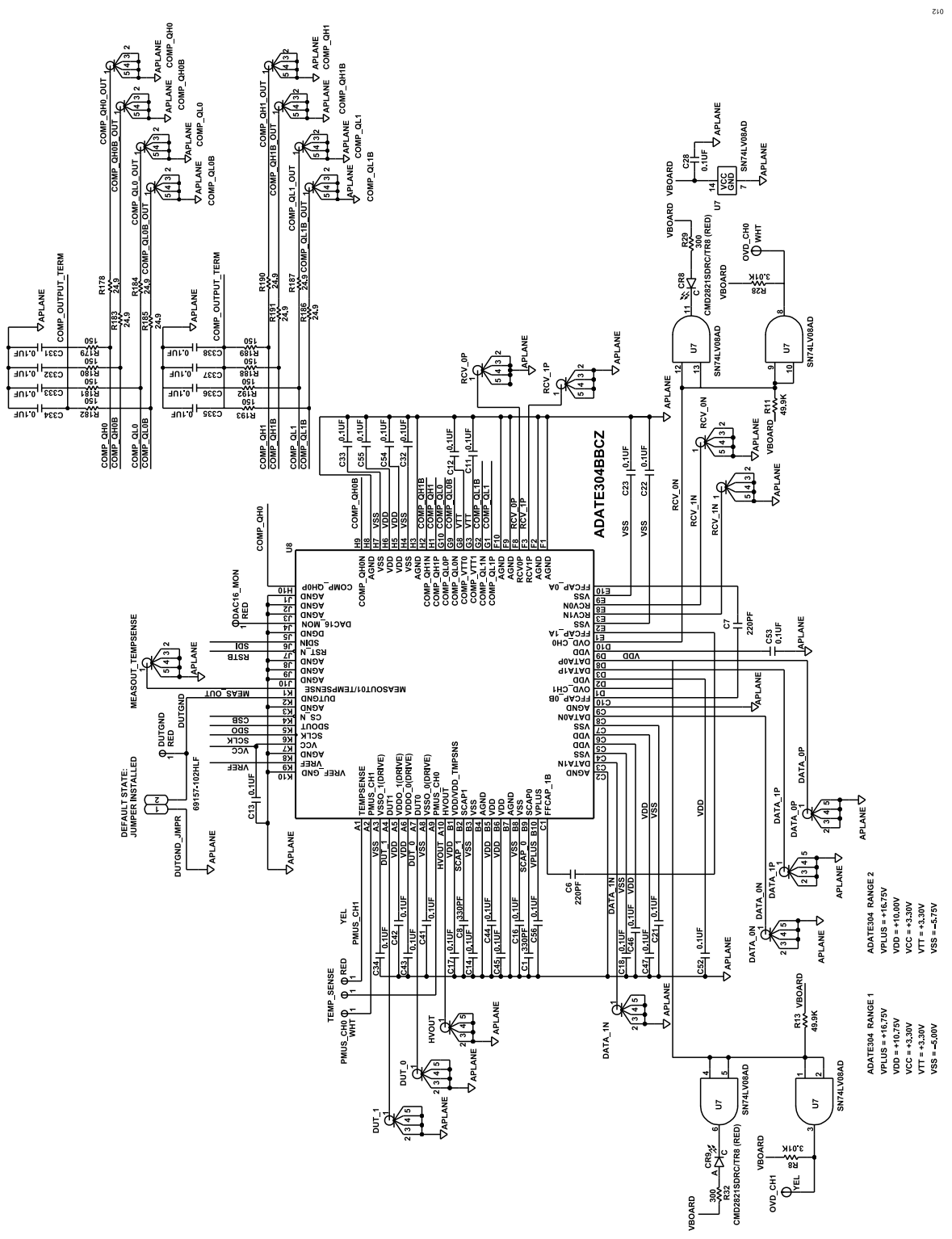


Figure 13. EVAL-ADATE304BBCZ Schematic, Page 1

EVALUATION BOARD SCHEMATICS AND ARTWORK

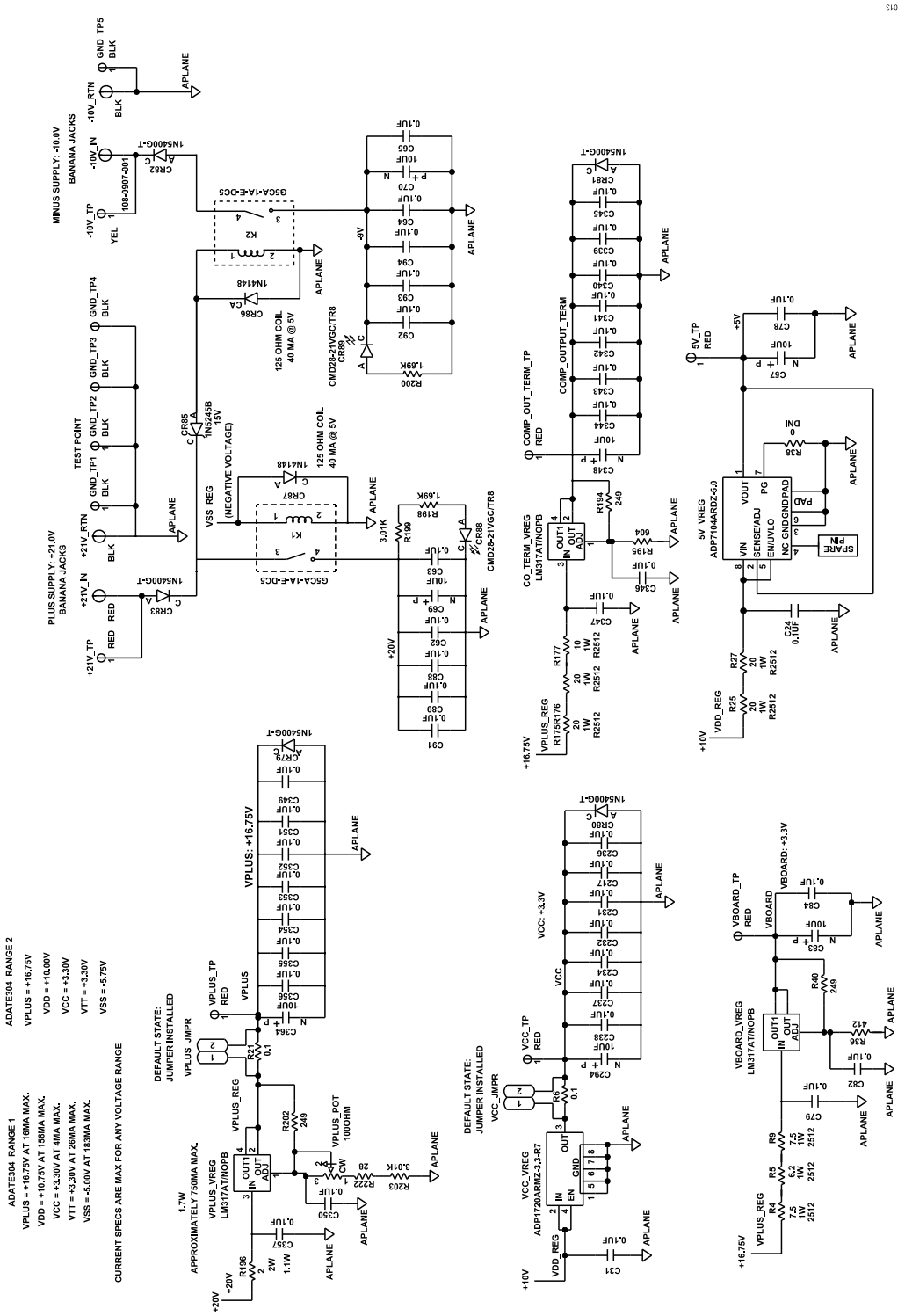


Figure 14. EVAL-ADATE304BBCZ Schematic, Page 2

EVALUATION BOARD SCHEMATICS AND ARTWORK

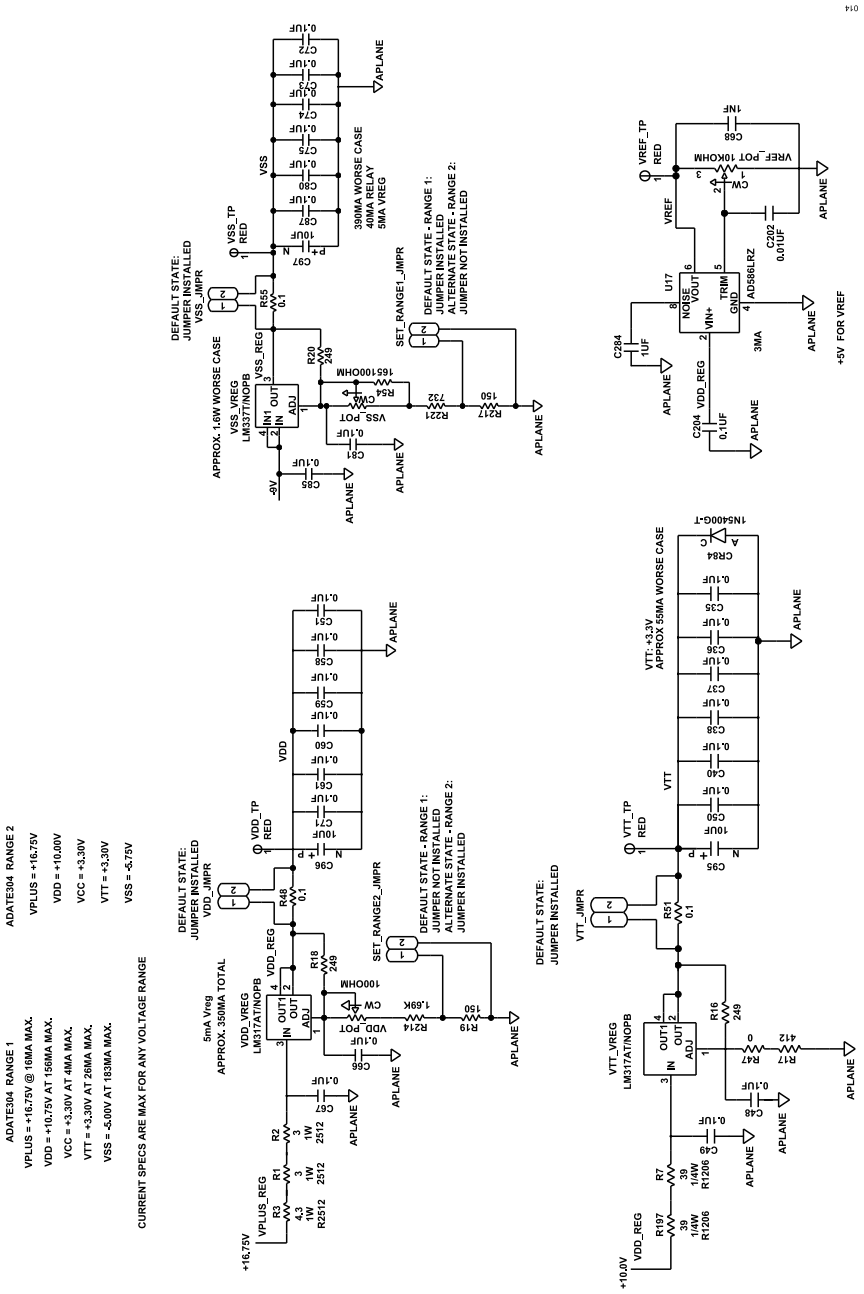


Figure 15. EVAL-ADATE304BBCZ Schematic, Page 3

EVALUATION BOARD SCHEMATICS AND ARTWORK

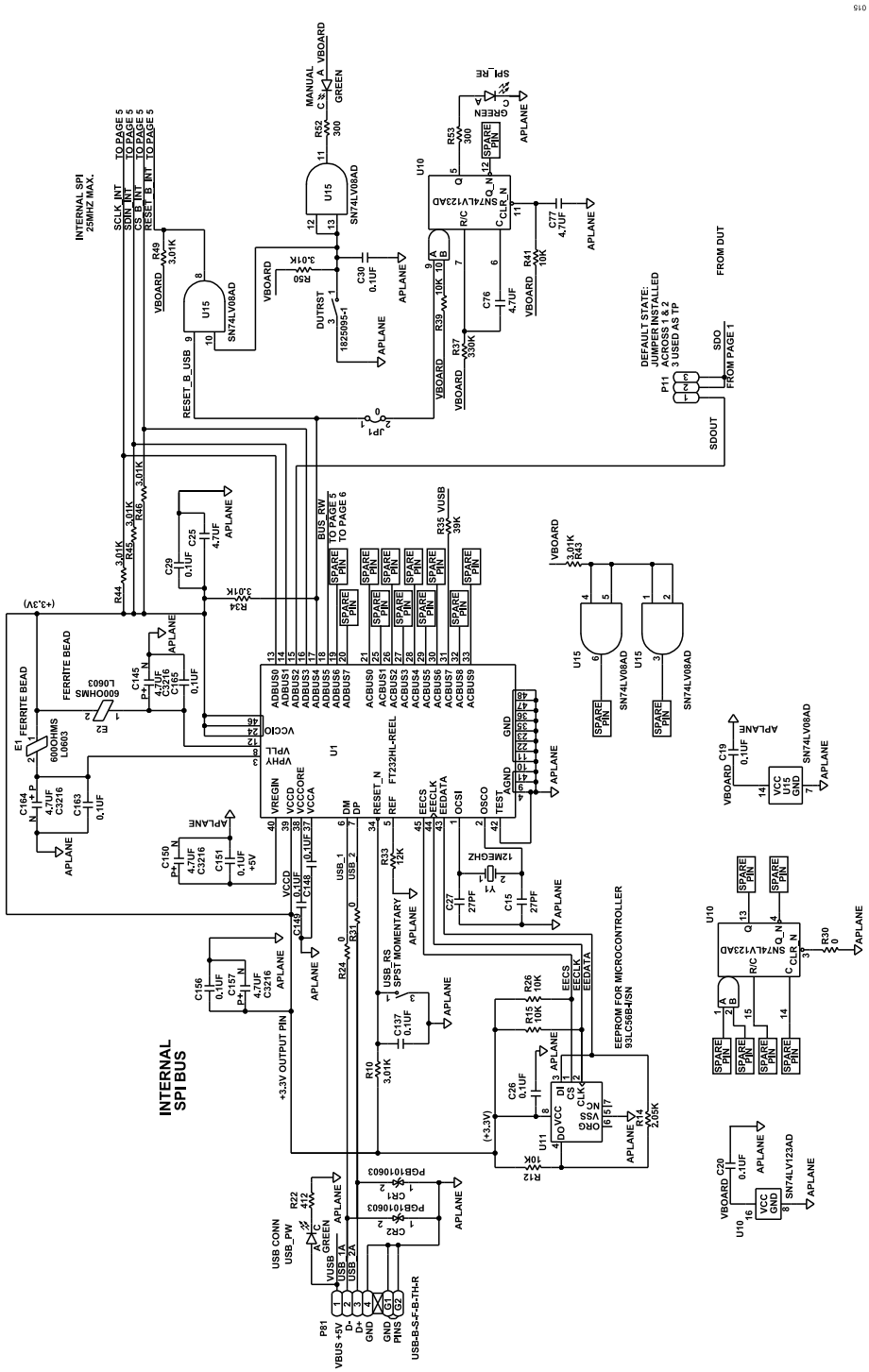


Figure 16. EVAL-ADATE304BBCZ Schematic, Page 4

EVALUATION BOARD SCHEMATICS AND ARTWORK

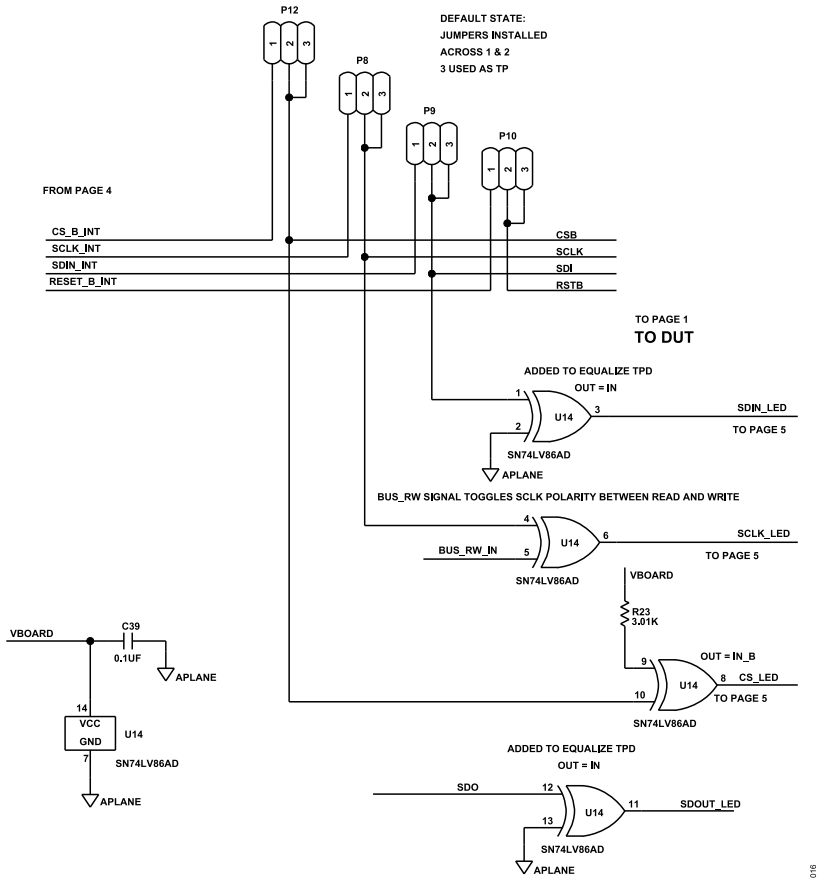


Figure 17. EVAL-ADATE304BBCZ Schematic, Page 5

EVALUATION BOARD SCHEMATICS AND ARTWORK

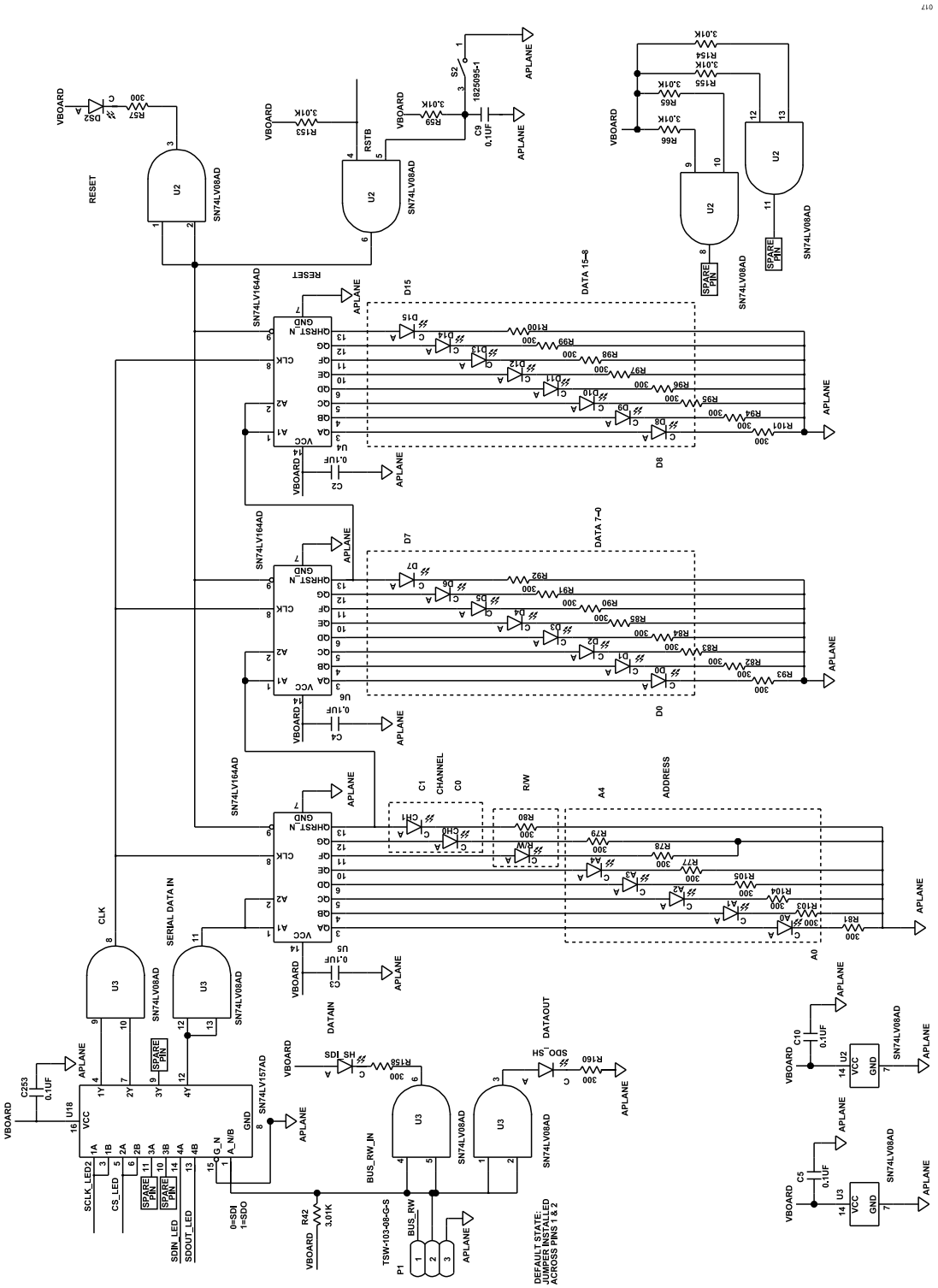


Figure 18. EVAL-ADATE304BBCZ Schematic, Page 6

EVALUATION BOARD SCHEMATICS AND ARTWORK

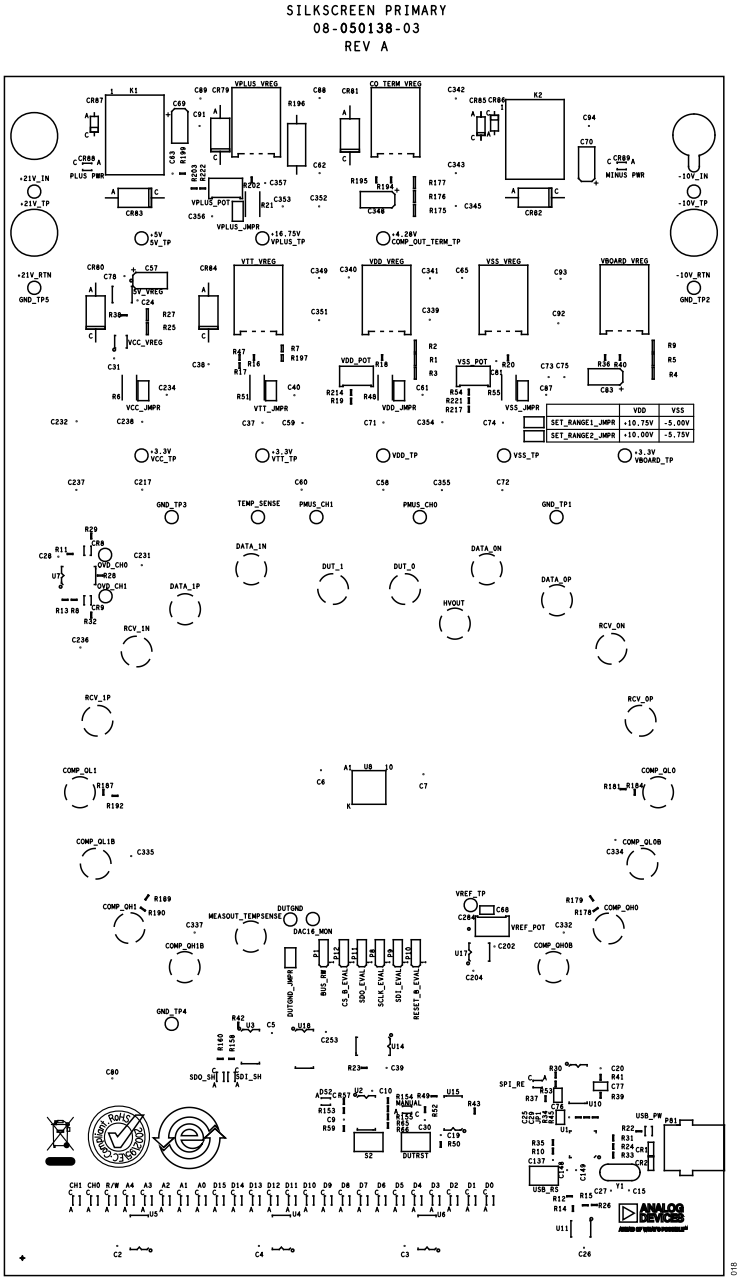


Figure 19. EVAL-ADATE304BBCZ Silkscreen, Primary

EVALUATION BOARD SCHEMATICS AND ARTWORK

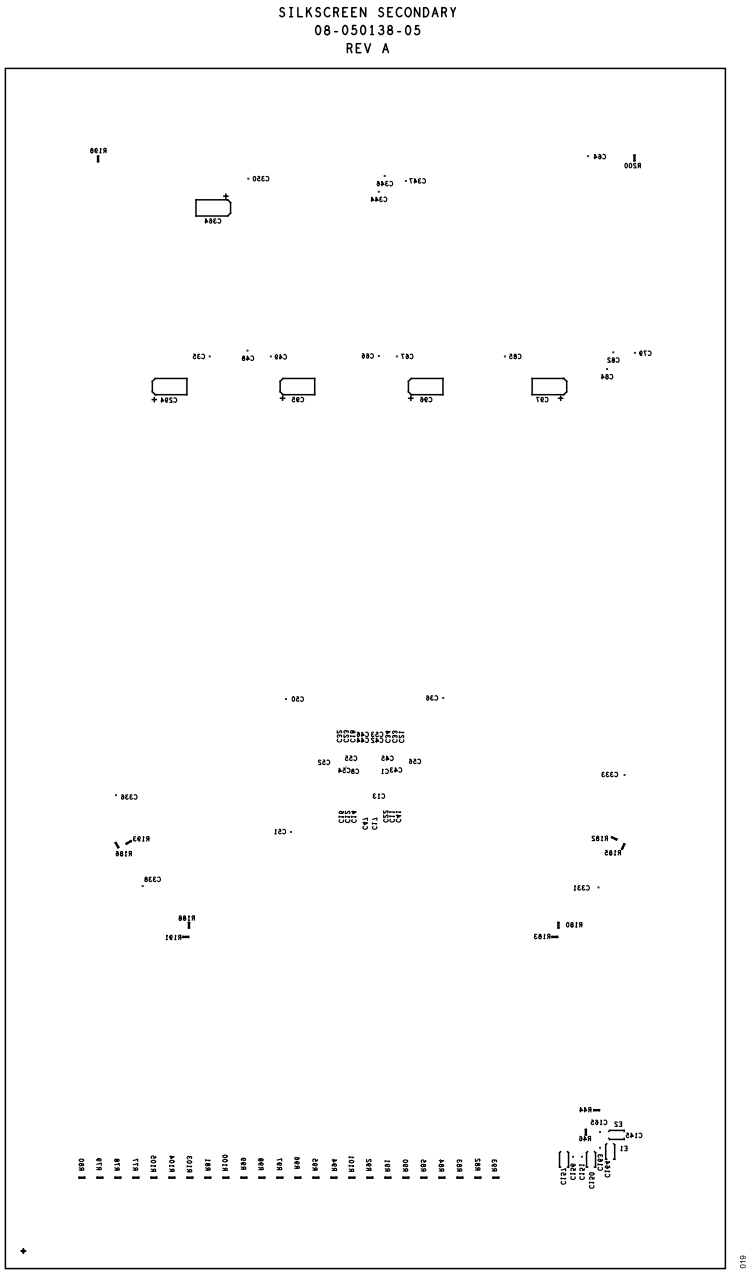


Figure 20. EVAL-ADATE304BBCZ Silkscreen, Secondary

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.