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## Si106X DEVELOPMENT KITS USER'S GUIDE

### 1. Kits Overview

This user's guide describes the development kits of the Si106x Wireless MCU family. The latest version of this user guide is available online at <http://www.silabs.com/products/wireless/wirelessmcu/Pages/default.aspx>. Each kit contains two RF nodes based on the Wireless Motherboard to support evaluation and development of sub-GHz RF links with the different Wireless MCUs. WMCU pico board content of the different kits is listed in Table 1, and content common to all the kits is listed in Table 2.

**Table 1. WMCU Pico Boards of the Si106x Development Kits**

| Qty | Description  | Part Number        |
|-----|--|--------------------|
|     | <b>Si1060 490 MHz Wireless MCU Development Kit</b> | <b>1060-490-DK</b> |
| 2   | Si1060 490 MHz PICO Board                          | 1060-PCE20C490     |
|     | <b>Si1060 915 MHz Wireless MCU Development Kit</b> | <b>1060-915-DK</b> |
| 2   | Si1060 915 MHz PICO Board                          | 1060-PCE20C915     |
|     | <b>Si1062 868 MHz Wireless MCU Development Kit</b> | <b>1062-868-DK</b> |
| 2   | Si1062 868 MHz PICO Board                          | 1062-PCE13D868     |
|     | <b>Si1064 434 MHz Wireless MCU Development Kit</b> | <b>1064-434-DK</b> |
| 2   | Si1064 434 MHz PICO Board                          | 1064-PCE10D434     |
|     | <b>Si1064 868 MHz Wireless MCU Development Kit</b> | <b>1064-868-DK</b> |
| 2   | Si1064 868 MHz PICO Board                          | 1064-PCE10D868     |
|     | <b>Si1064 915 MHz Wireless MCU Development Kit</b> | <b>1064-915-DK</b> |
| 2   | Si1064 915 MHz PICO Board                          | 1064-PCE10D915     |

**Table 2. Common Kit Content**

| Qty | Description                         | Part Number  |
|-----|-------------------------------------|--------------|
| 2   | Wireless Motherboard                | MSC-WMB912   |
| 2   | USB cable (USBA-USB mini)           |              |
| 2   | Antenna with SMA connection         | MSC-AT50-XXX |
| 4   | AA Battery                          |              |
| 1   | Si106x Development Kit User's Guide |              |

## 2. Software Setup

There are two software tools provided by Silicon Labs to aid in wireless MCU software development: the Wireless Development Suite (WDS) and the Silicon Labs Integrated Development Environment (IDE). To download and install the Silicon Labs IDE and unlimited Keil PK51 Professional Developer's Kit, follow this link:

<http://pages.silabs.com/lp-keil-pk51.html>.

The recommended starting point for wireless MCU development is the WDS software tool. This tool is able to identify the connected boards by reading their identification memories (EBID) and provides valuable help by greatly simplifying radio configuration, evaluation, and application development.

### 2.1. Hardware and Software Requirements for WDS

- Windows XP® or later
- Microsoft .NET framework 3.5 or later
- Silicon Labs CP210x VCP driver
- WDS v3.1.9.0 or later

The lack of the .NET framework and VCP driver are recognized during the WDS installation. The install wizard will install the missing components after prompting the user for permission.

### 2.2. Download WDS

WDS can be obtained from the Silicon Labs website free of charge from the following link:

<http://www.silabs.com/Support Documents/Software/WDS3-Setup.exe>.

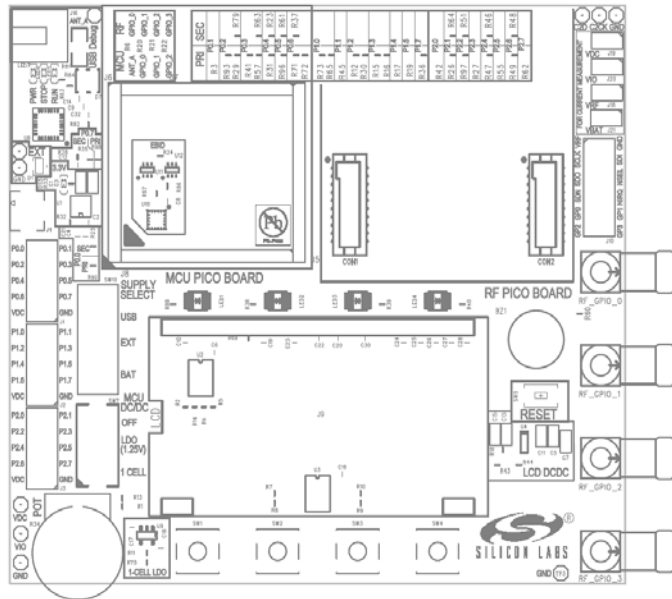
### 2.3. Installation Steps

**Note:** Before installing this software, local administration rights must be obtained from your network administrator.

1. Start WDS3-Setup.exe
2. Click "Next" to start the installation process
3. Accept the license agreement by clicking the check box, and then press the "Next" button.
4. Select the installation folder.  
It is recommended to use the default folder, C:\Program Files\Silabs\WDS3
5. When your settings are confirmed, click "Install" to continue.
6. Click "Finish" to close the WDS Installer.

### 3. Hardware Setup

After checking the kit contents against Tables 1 and 2, the kit can be put into operation by performing the steps listed below.



**Figure 1. Wireless Motherboard Top Markings**

1. Insert a WMCU Pico Board in connectors J5, J6, J7, J8 on the Wireless Motherboard (WMB). Align the triangle symbol on the WMCU Pico board with the triangle symbol on the WMB. *Do not connect any board to CON1 and CON2.*
2. Connect the antenna to the SMA connector on the WMCU Pico Board.
3. Set the SUPPLY SELECT switch to USB position.
4. Set the MCU DC/DC switch to OFF position.
5. All the CURRENT MEASUREMENT jumpers (J18-J21) must be in place.
6. Start the WDS on your PC.
7. Using one of the USB cables in the kit, connect the WMB to the PC.
8. Wait for Windows to install the driver of the debug interface if necessary.
9. WDS must identify the connected board and open an Application Manager window that lists information about the identified board.
10. Boards are shipped without preloaded software. Sample codes can be configured and downloaded to the WMCU from WDS. For details of how to use the WDS, see the WDS User's Guides listed in "5. Useful Documents" on page 5.

Repeat steps 1 to 9 for the other node of the kit. The two nodes are now ready for evaluation. For more details about the board's operation, see "6. The Wireless Motherboard Hardware Platform" on page 7 and "7. Board Schematics" on page 11. Detailed descriptions of the example codes can be found in separate application notes (see "5. Useful Documents" on page 5.)

## 4. Running a Simple Demo

The following is a quick-step guide to performing simple packet TX/RX.

1. Leave both nodes powered from the USB as described above.
2. Select "Radio Configuration Application".
3. From the Radio Configuration Application window, select "Standard Packet TX" for one node and "Standard Packet RX" for the other node.
4. Leave the default parameter settings untouched; simply click "Download project".
5. Now, the simple TX/RX sample project is running on the boards. When pressing one of the SW1 to SW4 buttons on the TX board, packets are sent, and the corresponding LED of LED1 to LED4 lights up during the transmission. On the RX side, LED1 is always on, while different combinations of LED2 to LED4 light up during successful packet reception according to the button pressed.

## 5. Useful Documents

Each member of the Wireless MCU family is composed of two chips, as shown in Table 3.

**Table 3. Wireless MCU Composition**

| Wireless MCU | Radio             | MCU       |
|--------------|-------------------|-----------|
| Si1060       | EZRadioPRO Si4463 | C8051F930 |
| Si1062       | EZRadioPRO Si4460 | C8051F930 |
| Si1064       | EZRadio Si4455    | C8051F930 |

This means that, in most cases, the application notes related to the composing chips are valid for the corresponding Wireless MCU. All those WMCU-related documents are available online at <http://www.silabs.com/products/wireless/Pages/default.aspx>.

For general information on the Wireless MCUs, see:

- Si106x Data Sheet

For detailed information on how to program the radio on the WMCUs, refer to the following documents:

Si1060 and Si1062:

- [AN626: Packet Handler Operation for Si446x RFICs](#)
- [AN633: Programming Guide for EZRadioPRO® Si4x6x devices](#)
- [EZRadioPRO API Documentation](#)

Si1064:

- [AN692: Si4355/Si4455 Programming Guide and Sample Codes](#)
- [EZRadio API Documentation](#)

Available Tools:

- [Silicon Laboratories IDE installer](#)
- [WDS3 installer](#)

For hardware design guidance see the following application notes:

- [AN791: Layout Design Guide for the Si106x/8x Wireless MCUs](#)

Si1060 and Si1062:

- [AN643: Si446x/Si4362 RX LNA Matching](#)

Si1060:

- [AN648: Si4063/Si4463/64 TX Matching](#)

Si1062:

- [AN627: Si4060/Si4460/61 Low-Power PA Matching](#)

# Si106x-DK

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Si1064:

- [AN686: Antennas for the Si4455/4355 RF ICs](#)
- [AN693: Si4455 Low-Power PA Matching](#)

For detailed information on lab measurements and data sheet parameter verification, refer to the following documents:

Si1060 and Si1062:

- [AN632: WDS User Guide for EZRadioPRO® Devices](#)

Si1064:

- [AN797: WDS User's Guide for EZRadio Devices](#)

## 6. The Wireless Motherboard Hardware Platform

The wireless motherboard platform is a demo, evaluation, and development platform for EZRadio and EZRadioPRO radio ICs. It consists of a wireless motherboard and interchangeable MCU and RF pico boards.

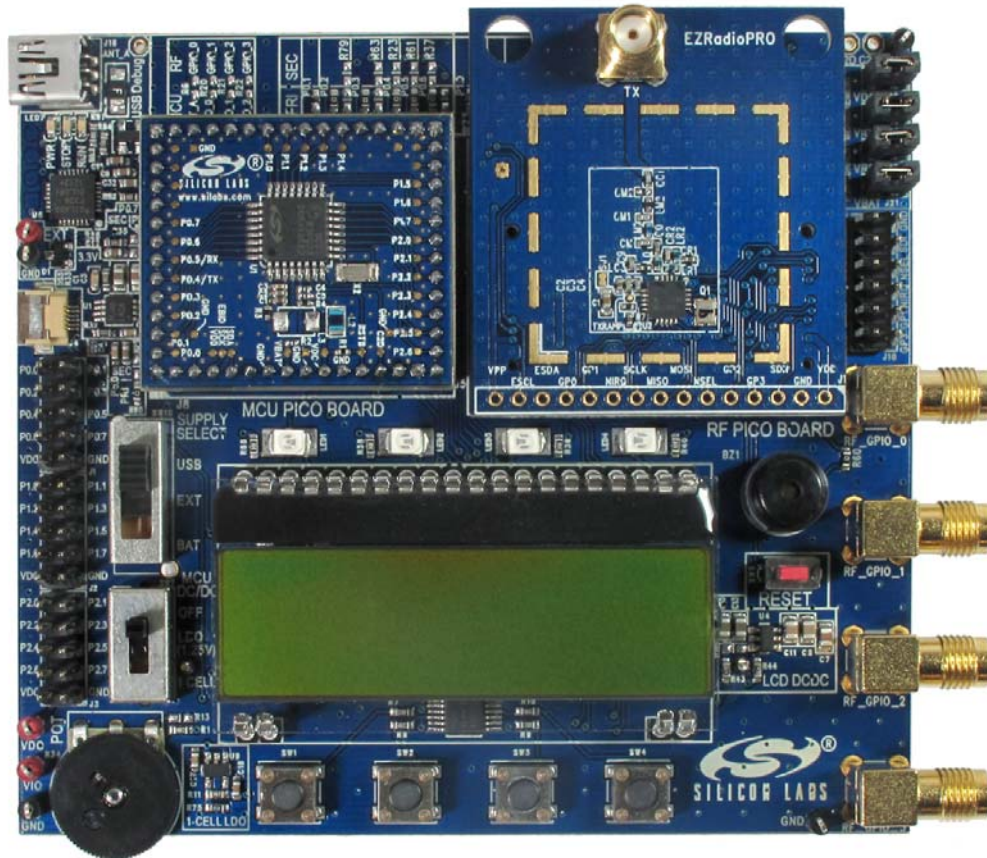
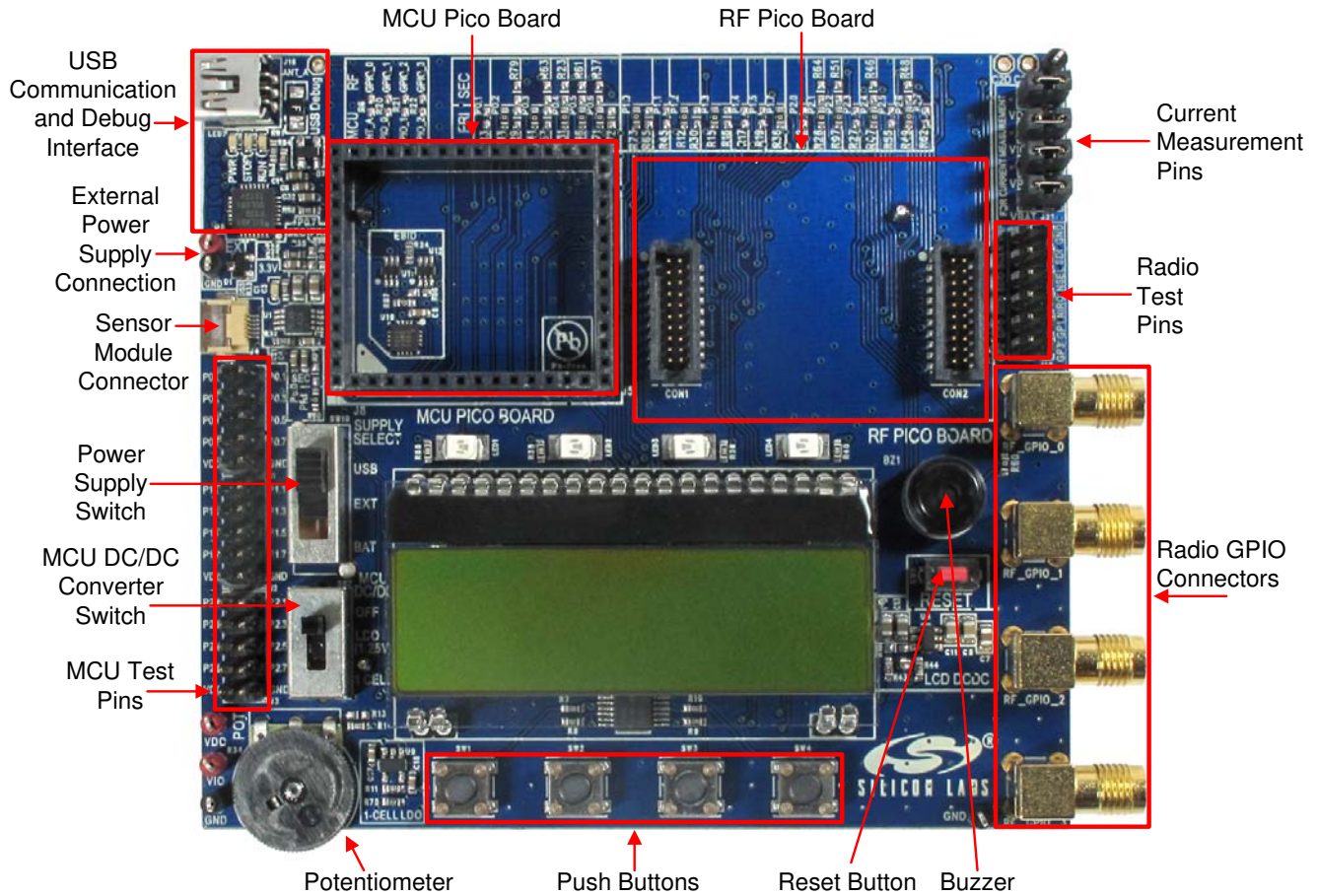


Figure 2. 8-Bit Wireless Motherboard Platform



## 6.1. The Wireless Motherboard



**Figure 3. Wireless Motherboard**

The wireless motherboard contains four pushbuttons, four LEDs, and a buzzer, which function as simple user interfaces. A graphical LCD displays menu items for range testing purposes, and a potentiometer demonstrates the analog capabilities of the MCU. A switch supports the power options of the MCU's built-in dc/dc converter. Using the current measurement jumpers, current consumption can be measured separately either for the MCU, the radio, or the peripherals. The motherboard contains test pins for all I/O pins of the MCU and for all digital pins of the radio. In addition, there are SMA connectors for the GPIOs of the radio for connection of test equipment. A USB communication interface as well as a built-in Silicon Labs USB-to-C2 debug adapter are integrated onto the board so that the wireless motherboard (WMB) can be directly connected via USB to the PC for downloading and debugging code on the MCU. There is also an interface connection for sensor modules. The MCU is also connected to the RF pico board through a connector pair.

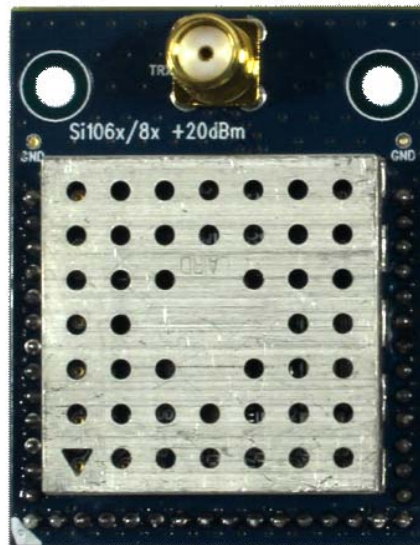
## 6.2. Power Scheme

The power source of the platform can be selected with the “SUPPLY SELECT” power supply selector switch on the WMB board. If this switch is in the “USB” position, supply voltage is provided by the PC that is connected to the “J16” mini USB connector. If this switch is in the “BAT” position, the supply voltage is provided by two AA batteries in the battery holder on the bottom side of the board. If the “SUPPLY SELECT” switch is in the “EXT” position, supply voltage is provided by an external power source through the “TP7” and “TP9” points.

Using the “MCU dc/dc” switch, the internal dc/dc converter of the C88051F930 MCU on the MCU pico board can be activated if the connected pico board supports this function. If the switch is in the “OFF” position, the MCU’s dc/dc converter is inactive, and the supply voltage is only determined by the state of the “SUPPLY SELECT” switch.

Positioning the switch to either “LDO (1.25 V)” or “1 CELL” position will turn on the MCU’s dc/dc converter by connecting 1.25–1.5 V supply voltage to the VBAT pin and removing external power from the VDC pin. The MCU will provide 1.9 V in the default setting on its VDC pin to all the other connected loads. Since this current is limited, it may be necessary to disconnect or disable some loading part of the board. For further details, see the MCU data sheet and the board schematic. The board schematic can be found in the EZRadioPRO Development Kit User’s Guide. A complete CAD design pack of the board is also available at [www.silabs.com](http://www.silabs.com).

## 6.3. WMCU Pico Board



**Figure 4. WMCU Pico Board Top Side**

The WMCU Pico board is a module that contains a WMCU IC, matching network, and an SMA connector on the top side. These components apart from the antenna connector are covered by a metal shield for noise reduction. The boards also have a factory-loaded board identification memory (EBID) on the bottom side that contains data describing the board properties. Any WMCU Pico board can be connected to the MCU Pico board connector (J5, J6, J8) of the WMB via the MCU Pico board connectors on the bottom side of the board. Since this module contains both the radio and the MCU functionality, the RF Pico board connector of the WMB (CON1 and CON2) must be left open.

# Si106x-DK

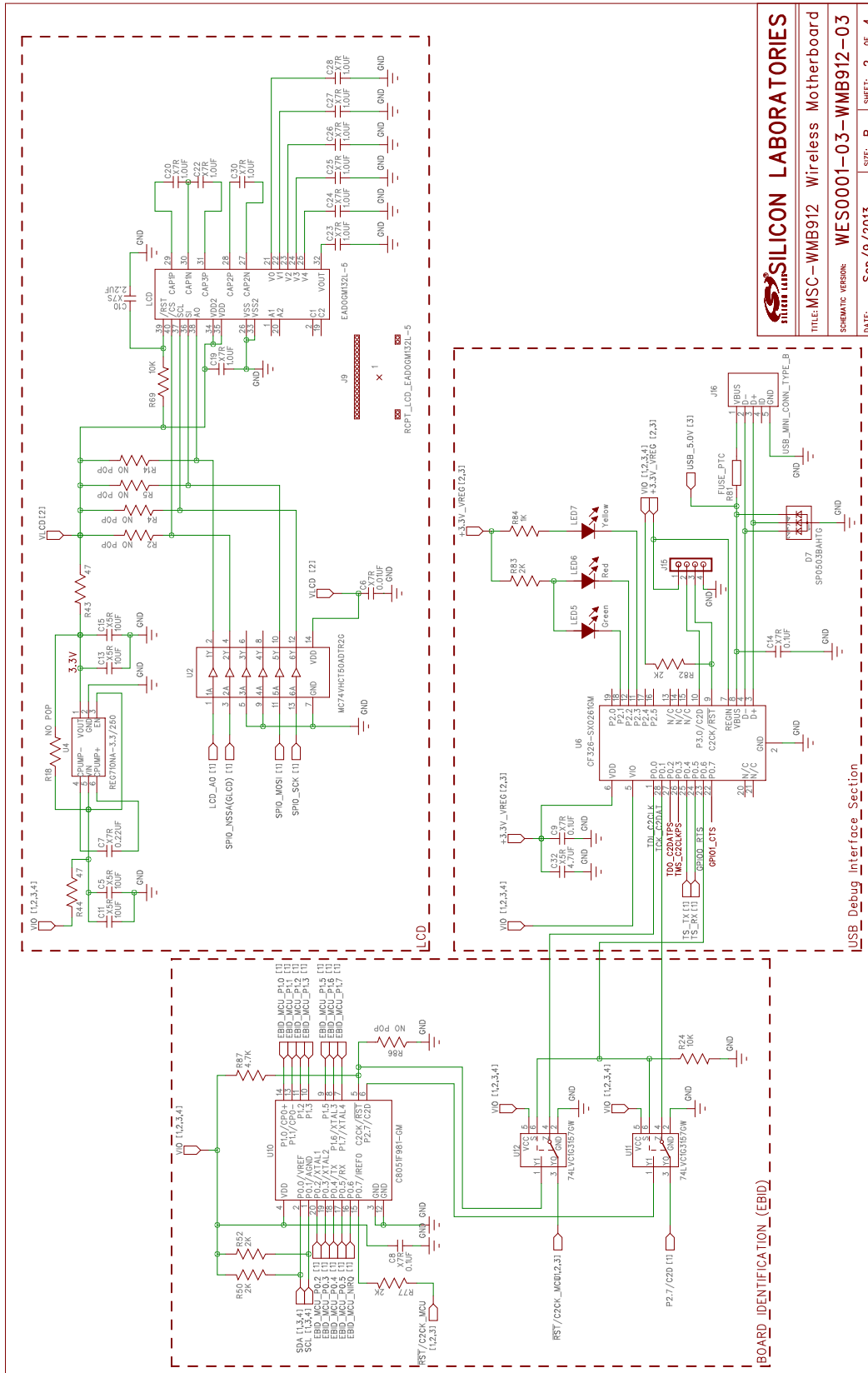
Table 4 lists the functions and connections of the WMCU GPIOs. Primary functions are factory-connected on the WMB. Secondary functions can be connected by desoldering a 0  $\Omega$  resistor that connects the primary function and soldering in to the proper position to connect the secondary function. Because of the limited number of MCU GPIOs of the WMCU, LEDs and pushbutton switches are connected to the EBID MCU of the WMB912 and can be accessed via the SMBUS on P1.4 and P1.5 of the WMCU.

**Table 4. WMCU GPIO Functions/Connections**

| WMCU Pin | WMB Board Test Pin Marking | MSC-WMB912 Primary Function | 0 $\Omega$ Resistor | MSC-WMB912 Sec. Function | 0 $\Omega$ Resistor |
|----------|----------------------------|-----------------------------|---------------------|--------------------------|---------------------|
| P0.0     | P0.0                       | EBID_MCU_NIRQ               | R78                 | LED1/SW1                 | R90                 |
| P0.1     | P0.1                       | EZR_NIRQ                    |                     |                          |                     |
| P0.2     | P0.2                       | SPI0_NSSA (GLCD*)           | R29                 | GPIO_0                   | R79                 |
| P0.3     | P0.3                       | SPI0_MOSI                   | R57                 | GPIO_1                   | R63                 |
| P0.4     | P0.4                       | TS_RX                       | R31                 | BUZZER                   | R23                 |
| P0.5     | P0.5                       | TS_TX                       | R96                 | GPIO_2                   | R61                 |
| P0.6     | P0.6                       | SPI0_SCK                    | R72                 | LED2/SW2                 | R71                 |
| (P0.7)   |                            | EZR_SDN*                    |                     |                          |                     |
| (P1.0)   |                            | EZR_SPI_SCK*                |                     |                          |                     |
| (P1.1)   |                            | EZR_SPI_MISO*               |                     |                          |                     |
| (P1.2)   |                            | EZR_SPI_MOSI*               |                     |                          |                     |
| (P1.3)   |                            | EZR_SPI_NSS3*               |                     |                          |                     |
| P1.4     | P2.1                       | I2C_SDA                     | R26                 | POT_EN                   | R64                 |
| P1.5     | P2.2                       | I2C_SCL                     | R97                 | POT                      | R51                 |
| P1.6     | P0.7                       | LCD_A0                      | R98                 | IREF                     | R35                 |

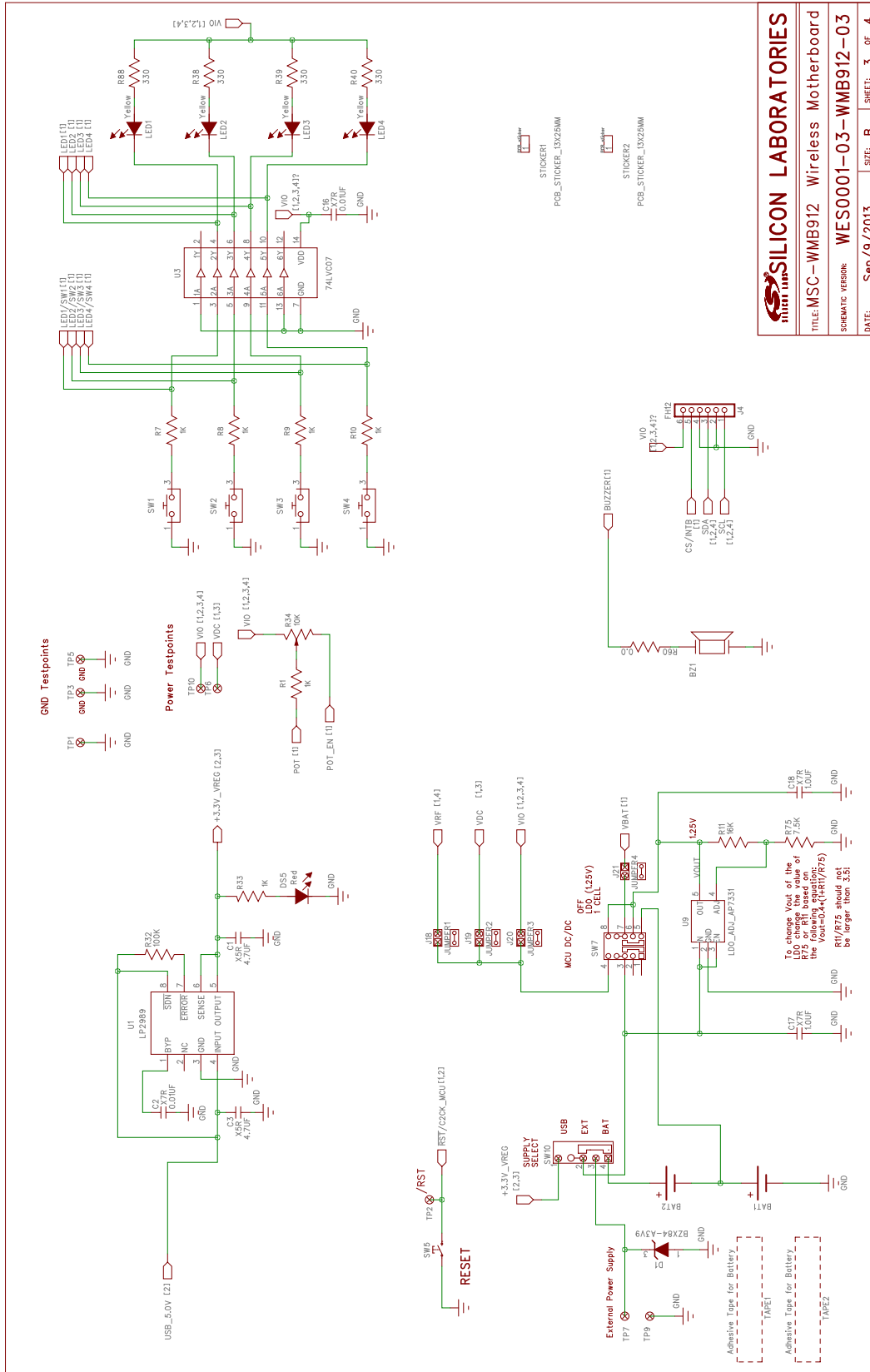
**\*Note:** This is an interface pin between the radio and the MCU and is connected internally in the WMCU package. It is neither accessible on the pins of the WMCU IC nor, therefore, on the test pins (J10) of the WMB.





|   |         |
|---|---------|
| <b>SILICON LABS</b>                     |         |
| <b>LABORATORIES</b>                     |         |
| TITLE: MSC-WMB912 Wireless Motherboard  |         |
| SCHEMATIC VERSION: WES0001-03-WMB912-03 |         |
| DATE: Sep/9/2013                        | SIZE: B |
| SHEET: 2                                | OF 4    |

Figure 6. MSC-WMB912 Wireless Motherboard Schematic (2/4)



**SILICON LABS LABORATORIES**

TITLE: MSC-WMB912 Wireless Motherboard

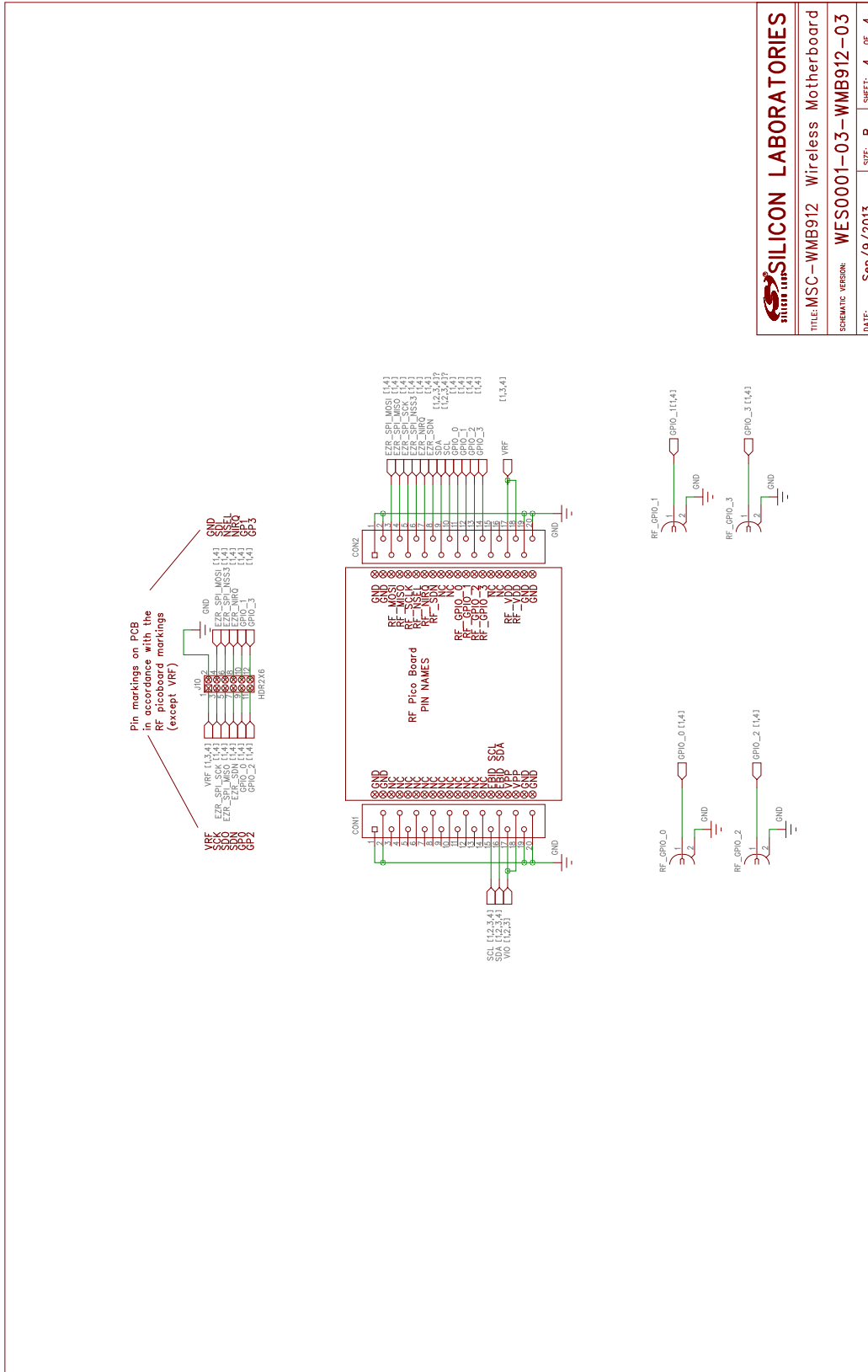
SCHEMATIC VERSION: WES0001-03-WMB912-03

DATE: Sep/9/2013

SIZE: B

SHEET: 3 OF 4

Figure 7. MSC-WMB912 Wireless Motherboard Schematic (3/4)



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TITLE: MSC-WMB912 Wireless Motherboard

SCHEMATIC VERSION: WES0001-03-WMB912-03

DATE: Sep/9/2013

SIZE: B

SHEET: 4 OF 4

Figure 8. MSC-WMB912 Wireless Motherboard Schematic (4/4)

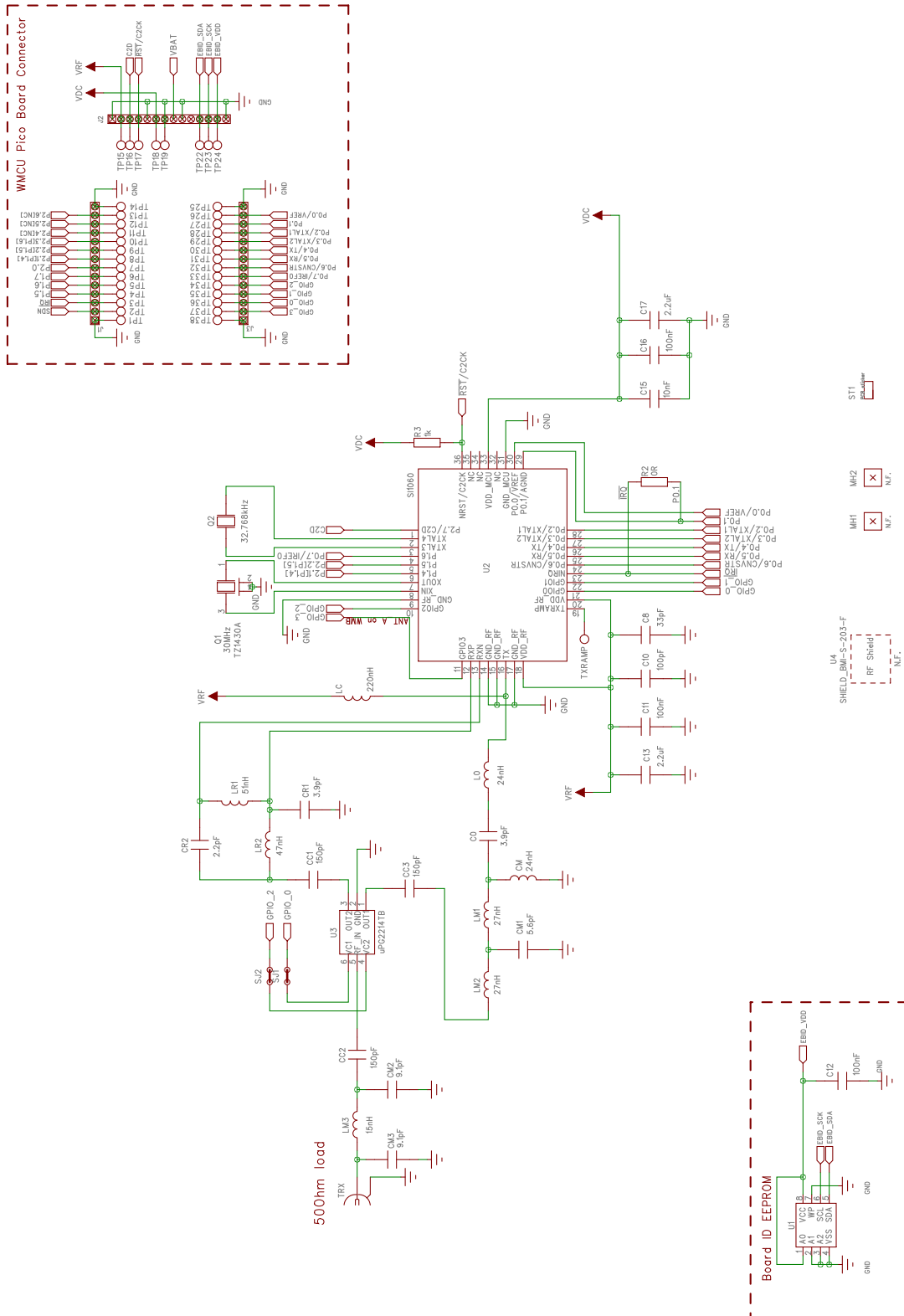


Figure 9. 1060-PCE20C490 WMCU Pico Board Schematic





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