

## Si501/2/3/4-EVB USER'S GUIDE

### Description

The Silicon Laboratories Si501-2-3-4-EVB is a USB plug-in board that allows for evaluation of the Si50x family of CMEMS oscillators. The Si501-2-3-4-EVB comes completely assembled, tested, and populated with one Si504 device and three empty expansion sites.

### Features

- Easy evaluation of Silicon Laboratories' Si501/2/3/4 CMEMS oscillators
- Windows-compatible control software—Si50x CMEMS Oscillator EVB GUI
- Powered by USB port
- Retains device configuration in FLASH for testing over temperature when not connected to USB
- SMA connectors for output clock connection to external test equipment or target systems
- Test points for direct measurement of device supply current
- On-board voltage regulator with jumper selectable operation of 1.8, 2.5, or 3.3 V



Figure 1. Si501-2-3-4-EVB Front Side View

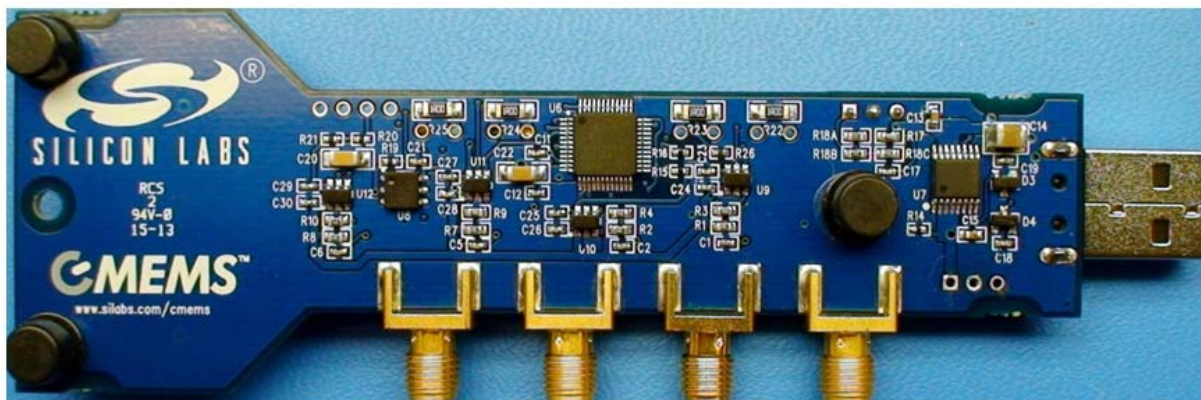
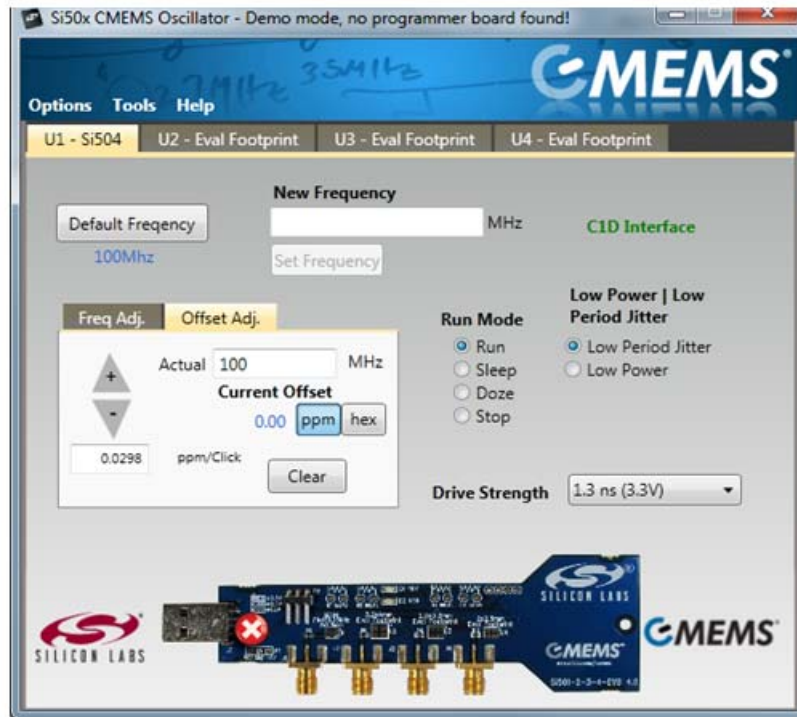


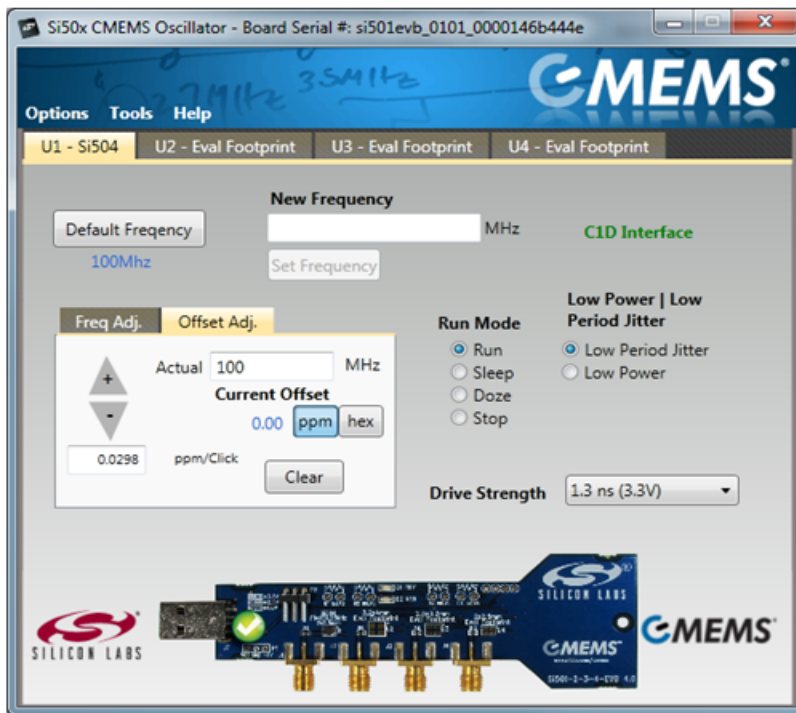
Figure 2. Si501-2-3-4-EVB Rear Side View

## 1. Quick Start

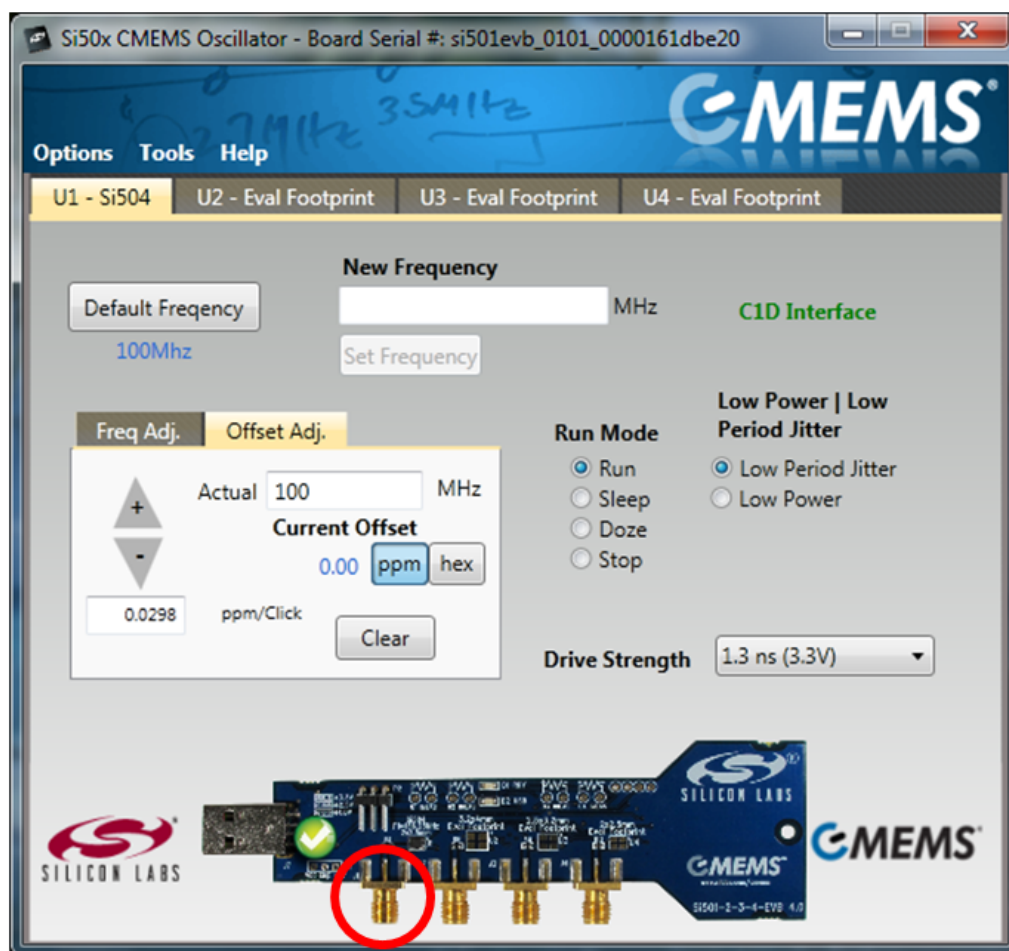
1. Install the Si50x EVB GUI software by downloading it from [www.silabs.com/Si501-2-3-4-EVB](http://www.silabs.com/Si501-2-3-4-EVB)
2. Launch the Si50x EVB GUI software. The following screen should appear on your desktop:



3. Insert the Si501-2-3-4-EVB board into an unused USB port. You should now see same screen as before, but with a green "check" next to EVB board graphic. EVB is now recognized by GUI software.

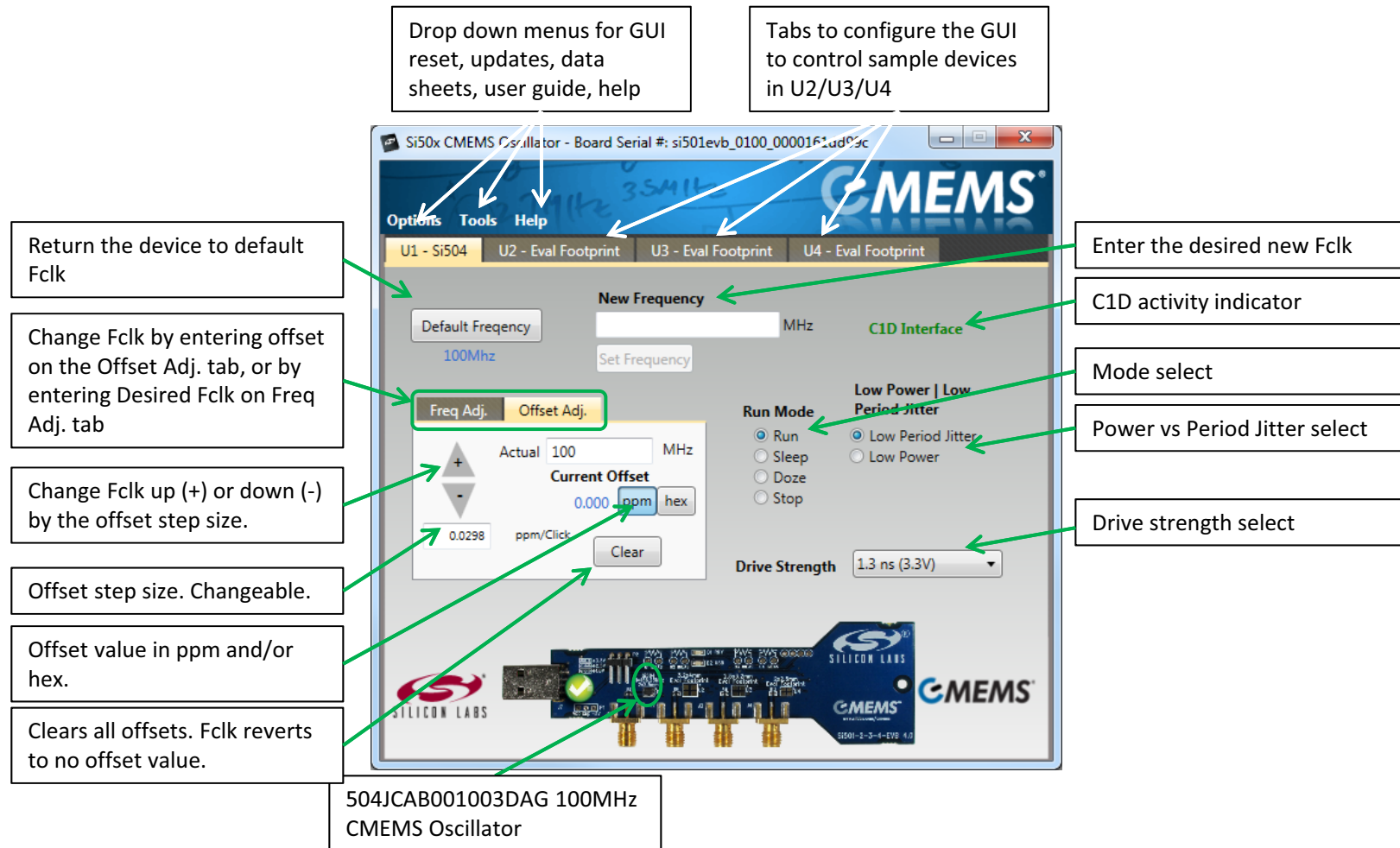


4. Default frequency clock of 100 MHz should now be output from SMA "J1" circled below.



5. To change the output frequency, enter a desired frequency in "New Frequency" field and press "Set Frequency" button.
6. The Si504 can be placed in any supported Run Mode or Power/Jitter mode by pressing the appropriate radio buttons. The GUI will automatically update the device.
7. The Freq Adj and Offset Adj tabs are for utilizing the frequency offset feature of the Si504. Use the Offset Adj tab to enter an offset in terms of PPM. Use the Freq Adj tab to enter an offset in terms of desired frequency.

## 1.1. EVB GUI Quick Start Guide



**Figure 3. Main Screen**

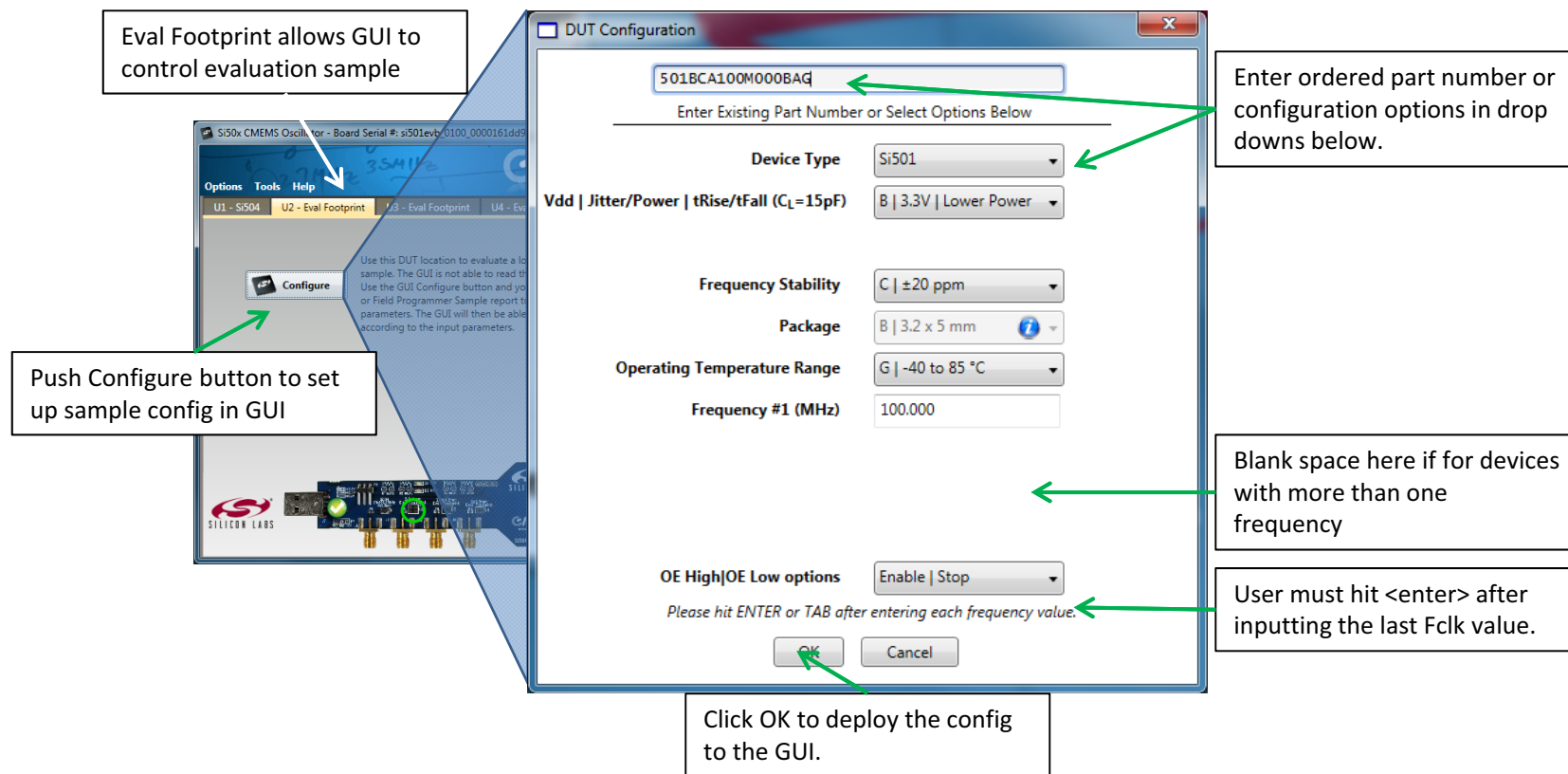
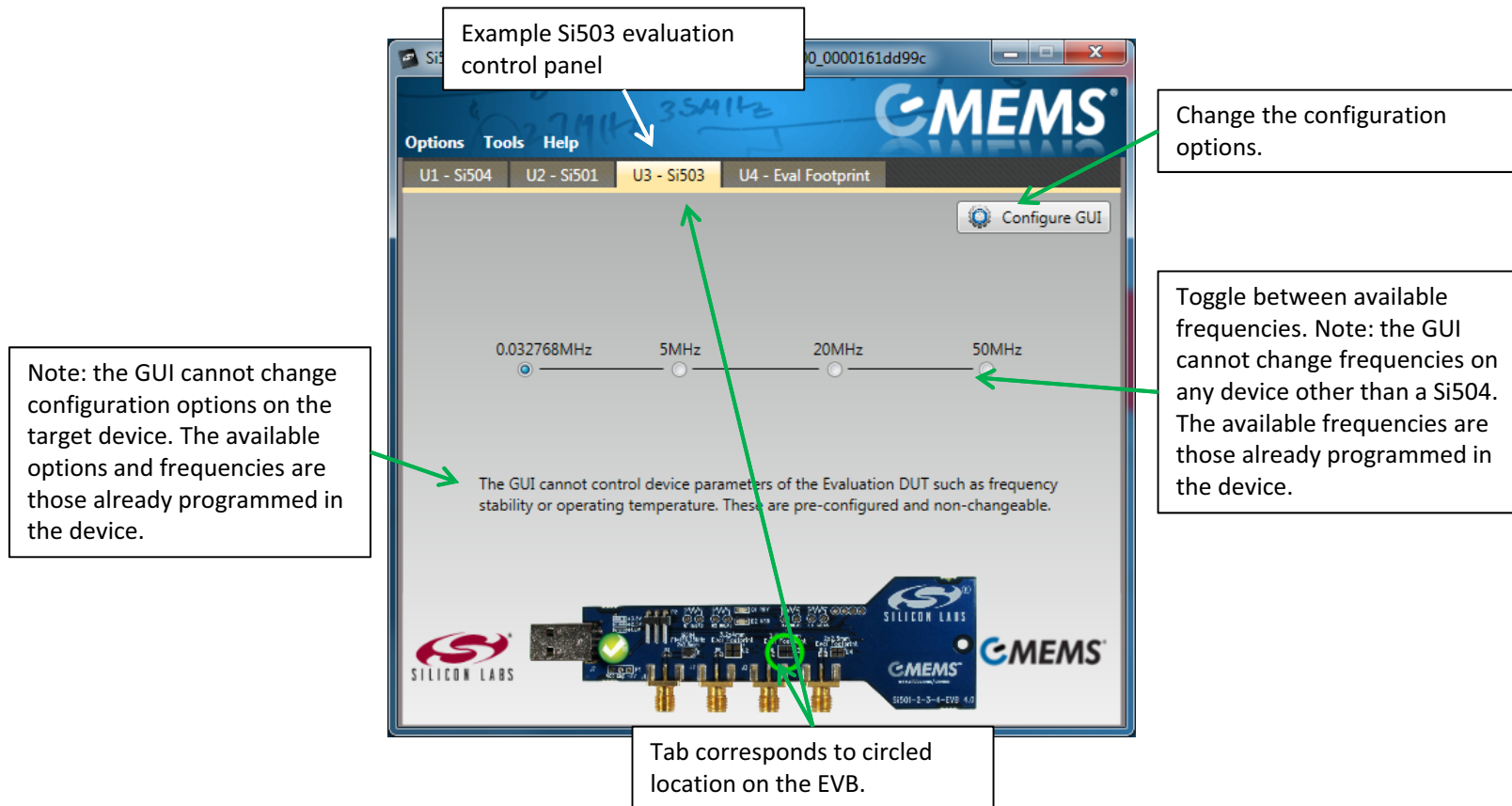


Figure 4. Eval Config Screen



**Figure 5. Eval Screen**

Table 1. Quick Start Drop Down Menus

| Drop Down Menu | Selection               | Function                                                                                                   |
|----------------|-------------------------|------------------------------------------------------------------------------------------------------------|
| Options        | Return GUI to Default   | Resets GUI completely to original settings. Clears all Eval Footprint settings and U1 504 settings.        |
|                | Exit                    | Exits GUI.                                                                                                 |
| Tools          | Check for EVB SW Update | Checks <a href="http://www.silabs.com">www.silabs.com</a> for any available GUI updates.                   |
|                | Check for EVB FW Update | Checks <a href="http://www.silabs.com">www.silabs.com</a> for any available FW updates for the EVB MCU.    |
|                | Advanced → Update FW    | Updates EVB FW with file saved to hard drive.                                                              |
|                | Save EVB Configuration  | Stores current EVB configuration to MCU FW. This is useful for temperature testing without USB connection. |
|                | Open EVB Configuration  | Find EVB configuration file on hard drive and load it to the GUI / EVB.                                    |
|                | Return EVB to Default   | Returns EVB FW to default settings.                                                                        |
| Help           | User's Guide            | Opens User's Guide pdf.                                                                                    |
|                | Device Data Sheet       | Opens latest device data sheet. Later revisions of the data sheet are loaded with new GUI SW updates.      |
|                | GUI Software Version    | Provides the GUI SW version number.                                                                        |
|                | EVB Firmware Version    | Provides the EVB FW version number.                                                                        |

## 2. MCU

The Silicon Laboratories MCU, P/N C8051F380, is mounted on the back side of the board at U6. The MCU provides the following functions:

- Supports USB communication to host PC
- Supports single-wire communication (C1) to the DUT on behalf of the host PC per the EVB GUI Software
- Supplies 3.3 V to peripheral ICs (the serial number generator and the C1 voltage level shifter)

## 3. Power Supply

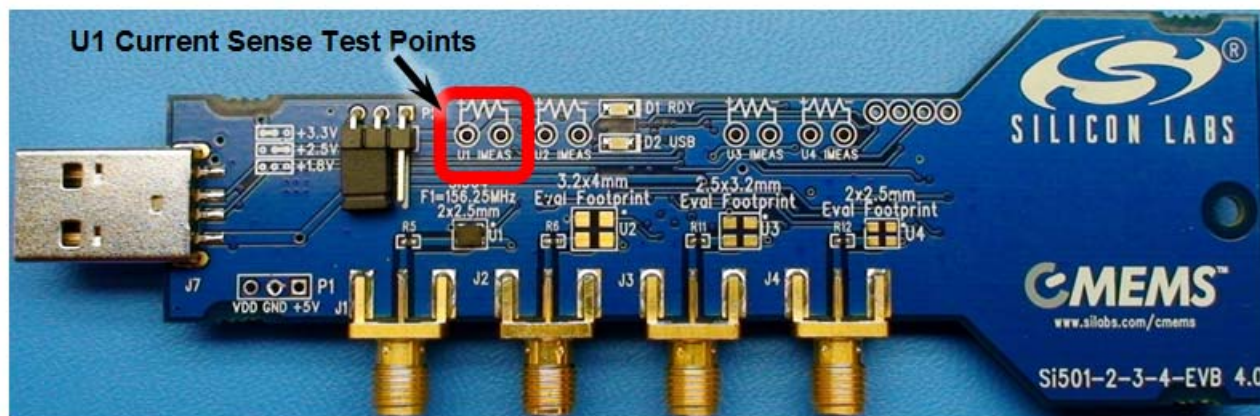
The Si501/2/3/4-EVB can be powered from USB or from an external voltage supply. This is to support temperature testing without a USB connection. The power supply consists of a Maxim MAX8869 adjustable voltage regulator that steps down the USB +5 V or an external +5V power supply to one of a selectable 1.8, 2.5, or 3.3 V. VDD selection is made via jumper P2. The supply voltage for all the device sites, both Si504 and eval sites, can be adjusted to one of three settings: 3.3 V, 2.5V, or 1.8 V by jumper P2. (Note that all four locations share the same supply voltage, so any supply voltage change will affect all devices at sites U1, U2, U3, and U4.) The default setting, connecting pins 2 and 3 as shown above, is 3.3 V. Moving the jumper to connect pins 1 and 2 results in 2.5 V. Removing the jumper altogether will result in 1.8 V supply voltage. The voltage regulator may be bypassed by connecting VDD directly to the VDD P1 connection point.



## 4. LEDs

Two green indicator LEDs are driven by the on-board MCU. A "Ready" LED (D1) is illuminated to indicate the EVB is recognized by the EVB GUI software and ready for use. A "USB" LED (D2) is illuminated whenever USB communications are actively in progress.

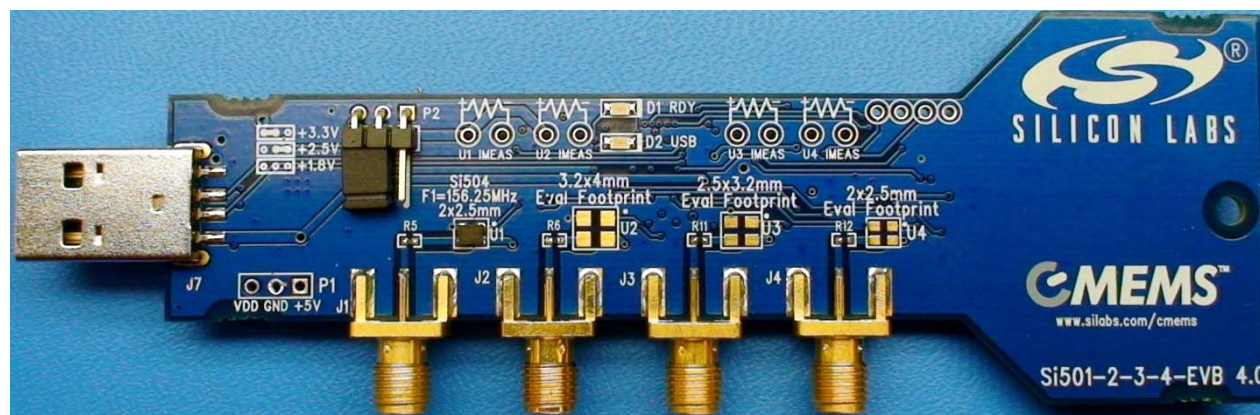
## 5. Current Sense Resistor



**Figure 6. Current Sense Resistor Location**

Each device site has a 1.0  $\Omega$  resistor in series with the VDD supply of that device. Both sides of that resistor are connected to a set of test points. This test point pair can be used to measure the voltage across that supply resistor, which indicates the supply current consumed by the respective device.

## 6. Outputs



**Figure 7. SMA Outputs**

Each device site output is connected to a SMA connector through a series resistor. J1 is the SMA connector output of the on-board Si504, with J2 through J4 corresponding to evaluation sites U2 through U4.

## 7. Schematics

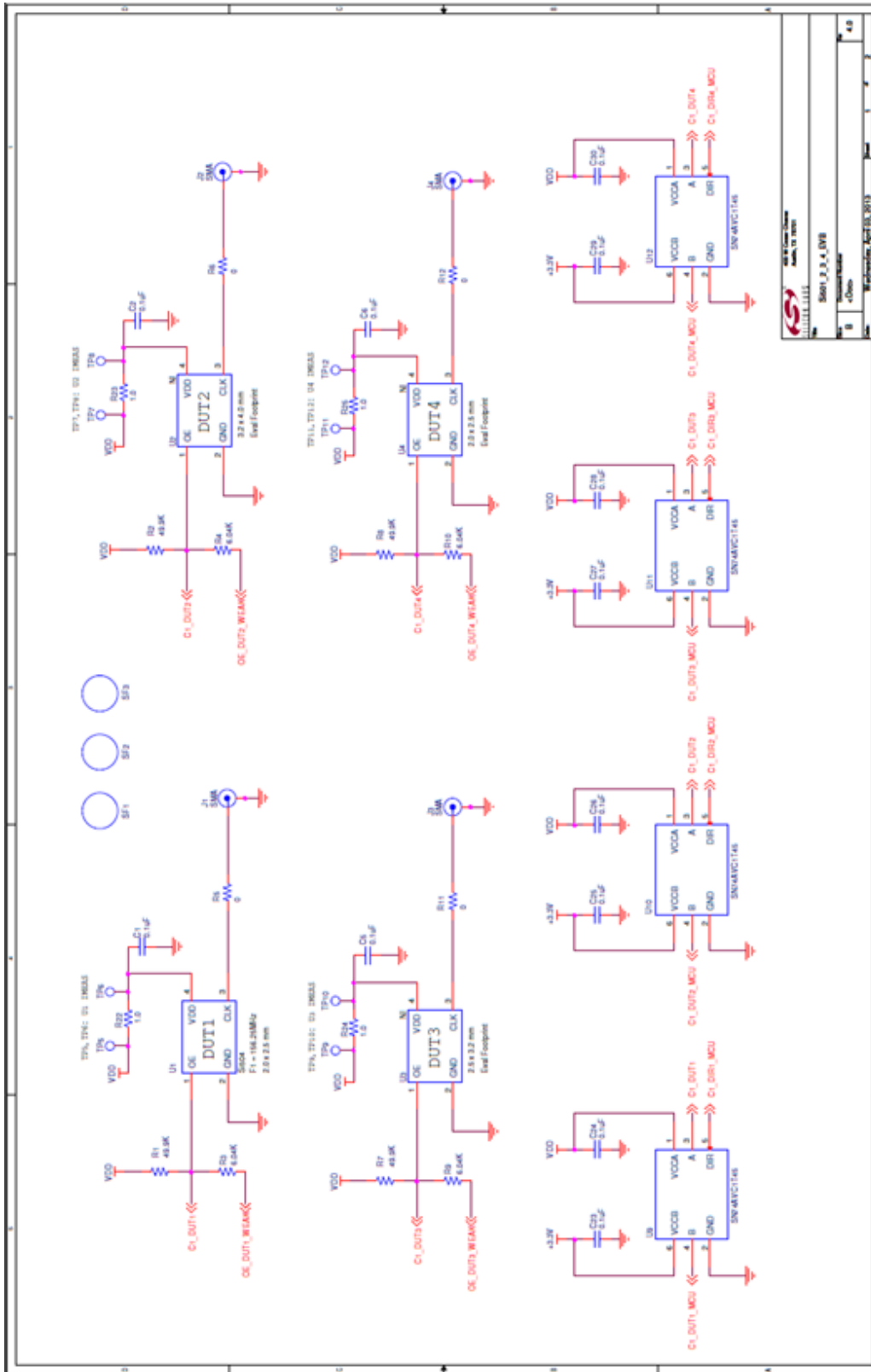
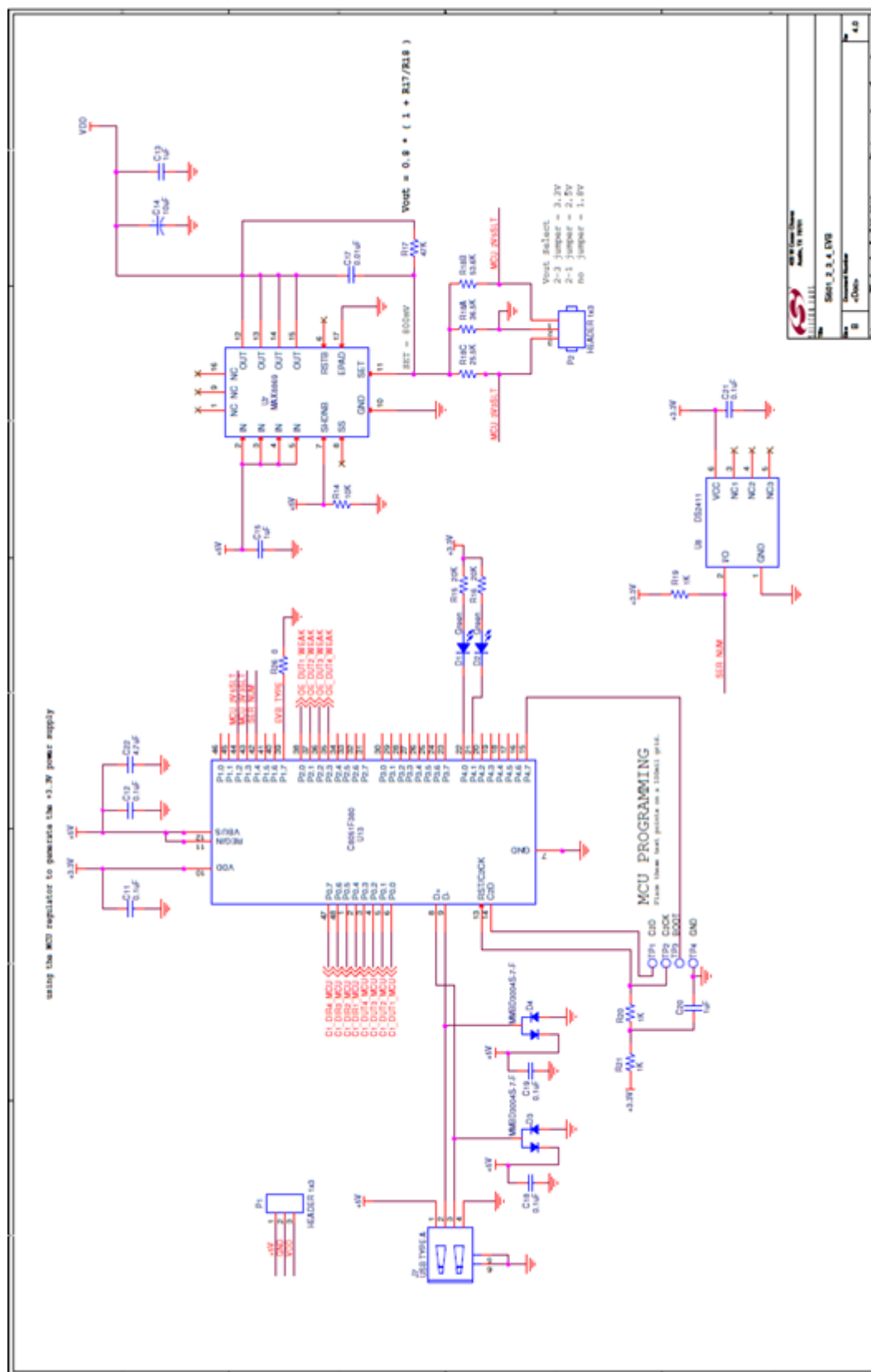


Figure 8. Si501/2/3/4 Schematic (1 of 2)



**Figure 9. Si501/2/3/4 Schematic (2 of 2)**

## 8. Bill of Materials

Table 2. Si501-2-3-4-EVB Rev 4.0

| NI | Qty | Reference                                                             | Value         | Rating | Volt | Tol        | Type          | PCB_Footprint | ManufacturerPN    | Manufacturer       |
|----|-----|-----------------------------------------------------------------------|---------------|--------|------|------------|---------------|---------------|-------------------|--------------------|
|    | 17  | C1 C2 C5 C6 C11 C12 C18<br>C19 C21 C23 C24 C25<br>C26 C27 C28 C29 C30 | 0.1 $\mu$ F   |        | 10V  | $\pm 10\%$ | X7R           | C0402 C0402L  | C0402X7R100-104K  | Venkel             |
|    | 2   | C13 C15                                                               | 1 $\mu$ F     |        | 10V  | $\pm 10\%$ | X7R           | C0603         | C0603X7R100-105K  | Venkel             |
|    | 1   | C14                                                                   | 10 $\mu$ F    |        | 25V  | $\pm 20\%$ | X7R           | C1210         | C1210X7R250-106M  | Venkel             |
|    | 1   | C17                                                                   | 0.01 $\mu$ F  |        | 10V  | $\pm 20\%$ | X7R           | C0402         | C0402X7R100-103M  | Venkel             |
|    | 1   | C20                                                                   | 1 $\mu$ F     |        | 25V  | $\pm 10\%$ | X7R           | C1206         | C1206X7R250-105K  | Venkel             |
|    | 1   | C22                                                                   | 4.7 $\mu$ F   |        | 10V  | $\pm 20\%$ | X7R           | C1206         | C1206X7R100-475M  | Venkel             |
|    | 2   | D1 D2                                                                 | Green         | 20mA   | 3.4V |            | SMT, Chip-LED | LED-HSMX-C170 | HSMQ-C170         | Avago Technologies |
|    | 2   | D3 D4                                                                 | MMBD3004S-7-F | 225mA  | 300V |            | Dual          | SOT23-AKC     | MMBD3004S-7-F     | Diodes Inc.        |
|    | 4   | J1 J2 J3 J4                                                           | SMA           |        |      |            | SMA           | SMA-EDGE-3    | 142-0701-801      | Johnson Components |
|    | 1   | J7                                                                    | USB TYPE A    |        |      |            | USB           | USB_A_RA_SMT  | 48037-1000        | Molex              |
|    | 1   | P2                                                                    | HEADER 1x3    |        |      |            | Header        | CONN1X3-MRA   | TSW-103-08-T-S-RA | Samtec             |
|    | 4   | R1 R2 R7 R8                                                           | 49.9K         | 1/16W  |      | $\pm 1\%$  | ThickFilm     | R0603         | CR0603-16W-4992F  | Venkel             |
|    | 1   | R14                                                                   | 10K           | 1/16W  |      | $\pm 5\%$  | ThickFilm     | R0402         | CR0402-16W-103J   | Venkel             |
|    | 2   | R15 R16                                                               | 20K           | 1/16W  |      | $\pm 1\%$  | ThickFilm     | R0402         | CR0402-16W-2002F  | Venkel             |
|    | 1   | R17                                                                   | 47K           | 1/16W  |      | $\pm 1\%$  | ThickFilm     | R0603         | CR0603-16W-4702F  | Venkel             |
|    | 1   | R18A                                                                  | 36.5K         | 1/16W  |      | $\pm 1\%$  | ThickFilm     | R0603         | CR0603-16W-3652F  | Venkel             |
|    | 1   | R18B                                                                  | 53.6K         | 1/10W  |      | $\pm 1\%$  | ThickFilm     | R0603         | CR0603-10W-5362F  | Venkel             |

Table 2. Si501-2-3-4-EVB Rev 4.0 (Continued)

| NI                       | Qty | Reference                                                | Value       | Rating | Volt         | Tol | Type      | PCB_Footprint          | ManufacturerPN       | Manufacturer |
|--------------------------|-----|----------------------------------------------------------|-------------|--------|--------------|-----|-----------|------------------------|----------------------|--------------|
|                          | 1   | R18C                                                     | 25.5K       | 1/16W  |              | ±1% | ThickFilm | R0603                  | CR0603-16W-2552F     | Venkel       |
|                          | 3   | R19 R20 R21                                              | 1K          | 1/16W  |              | ±5% | ThickFilm | R0402                  | CR0402-16W-102J      | Venkel       |
|                          | 4   | R22 R23 R24 R25                                          | 1.0         | 1/4W   |              | ±5% | ThickFilm | R1206                  | CR1206-4W-1R0J       | Venkel       |
|                          | 4   | R3 R4 R9 R10                                             | 6.04K       | 1/16W  |              | ±1% | ThickFilm | R0603                  | CR0603-16W-6041F     | Venkel       |
|                          | 5   | R5 R6 R11 R12 R26                                        | 0           | 1A     |              |     | ThickFilm | R0402 R0402L           | CR0402-16W-000       | Venkel       |
|                          | 3   | SF1 SF2 SF3                                              | BUMPER      |        |              |     |           | RUBBER_-<br>FOOT_SMALL | SJ61A6               | 3M           |
|                          | 1   | U1                                                       | 100 MHz     |        |              |     | MEMS      | OSC4N2.0X2.5           | 504JCAB001003DA<br>G | SiLabs       |
|                          | 1   | U13                                                      | C8051F380   |        |              |     | MCU       | QFP48N9X9P0.5          | CF380-PX0746GQ       | SiLabs       |
|                          | 1   | U7                                                       | MAX8869     | 1A     |              |     | LDO       | TSSOP16N6.5P0.6<br>5E  | MAX8869EUE50         | Maxim        |
|                          | 1   | U8                                                       | DS2411      |        |              |     |           | SOJ6N4.45P1.27         | DS2411P+             | Maxim        |
|                          | 4   | U9 U10 U11 U12                                           | SN74AVC1T45 |        | 1.2-<br>3.6V |     |           | SOT6N2.8P0.95          | SN74AVC1T45DBV       | TI           |
| Not Installed Components |     |                                                          |             |        |              |     |           |                        |                      |              |
| NI                       | Qty | Reference                                                | Value       | Rating | Volt         | Tol | Type      | PCB_Footprint          | ManufacturerPN       | Manufacturer |
| NI                       | 1   | P1                                                       | HEADER 1x3  |        |              |     | Header    | CONN-1X3               | TSW-103-07-L-S       | Samtec       |
| NI                       | 12  | TP1 TP2 TP3 TP4 TP5 TP6<br>TP7 TP8 TP9 TP10<br>TP11 TP12 | WHITE       |        |              |     | Loop      | TESTPOINT              | 151-201-RC           | Kobiconn     |
| NI                       | 1   | U2                                                       | xxMHz       |        |              |     | MEMS      | OSC4N3.2X5.0           |                      | SiLabs       |
| NI                       | 1   | U3                                                       | xxMHz       |        |              |     | MEMS      | OSC4N3.2X2.5           |                      | SiLabs       |
| NI                       | 1   | U4                                                       | xxMHz       |        |              |     | MEMS      | OSC4N2.0X2.5           |                      | SiLabs       |

## 9. Layout

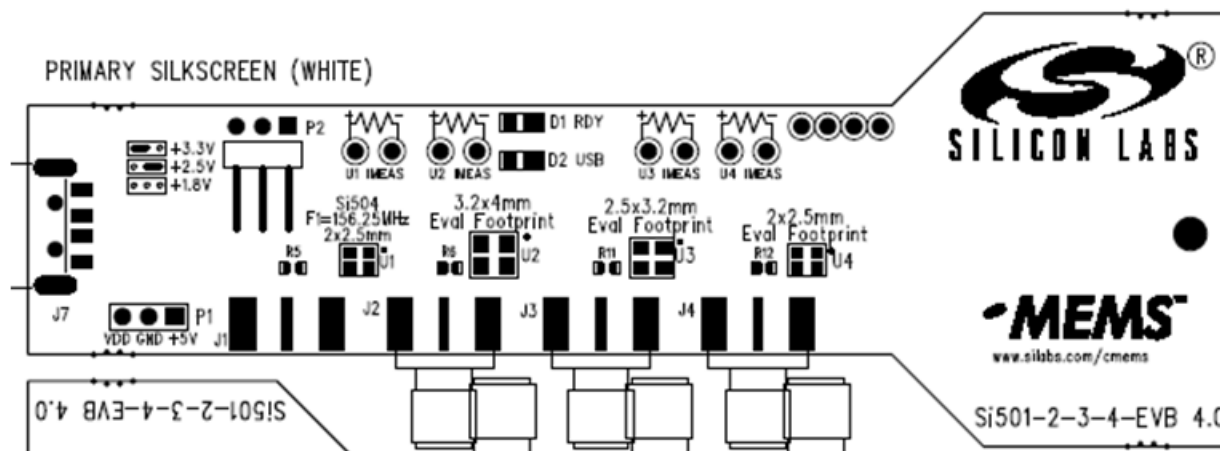


Figure 10. Front Side Assembly

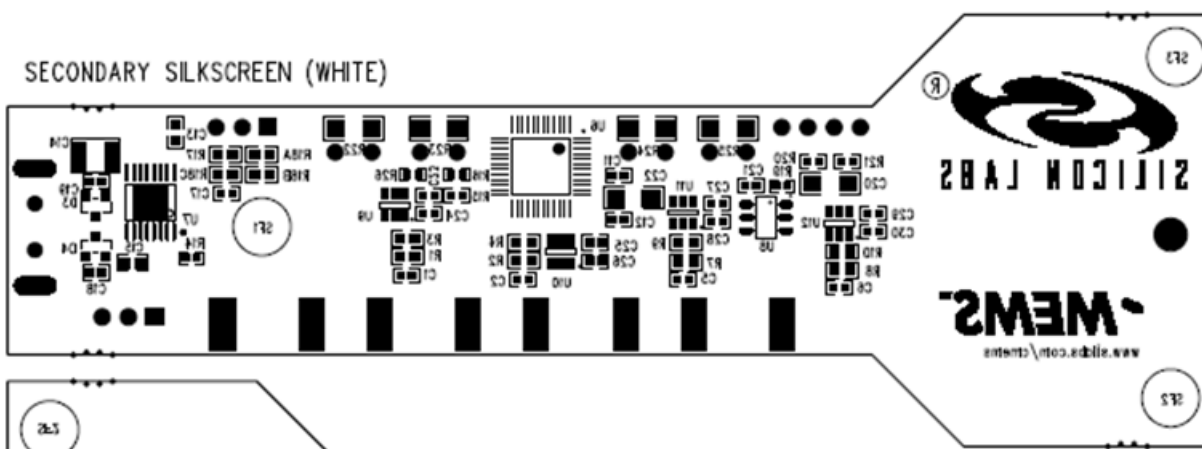


Figure 11. Rear Side Assembly

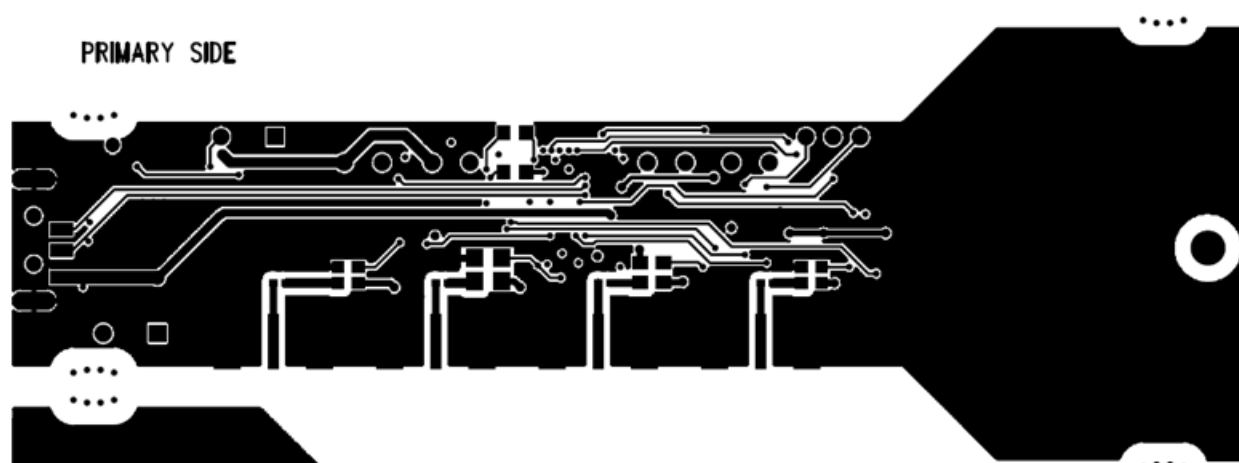


Figure 12. Front Side (Layer 1)



Figure 13. Front Side Inner Layer 1



Figure 14. Front Side Inner Layer 2

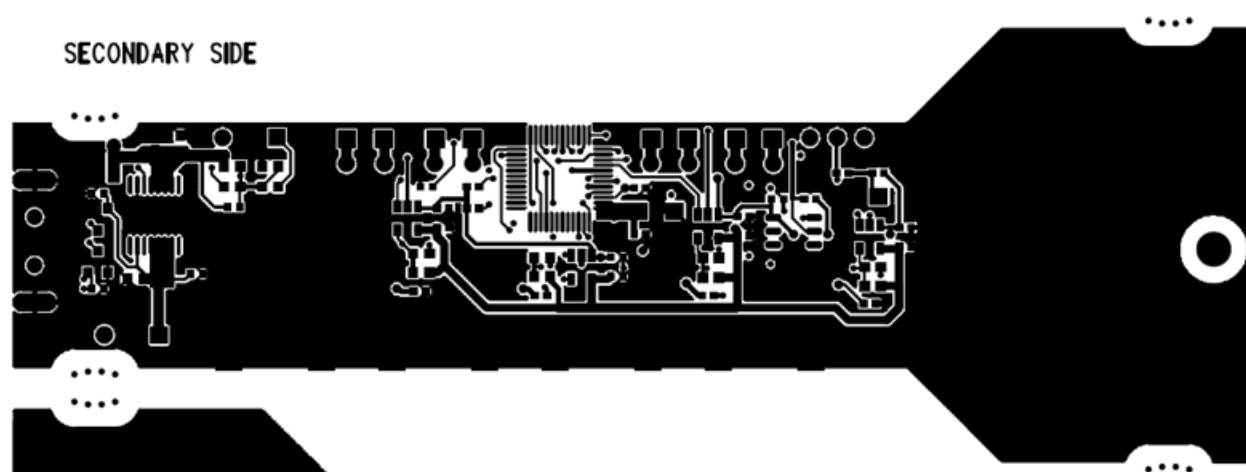
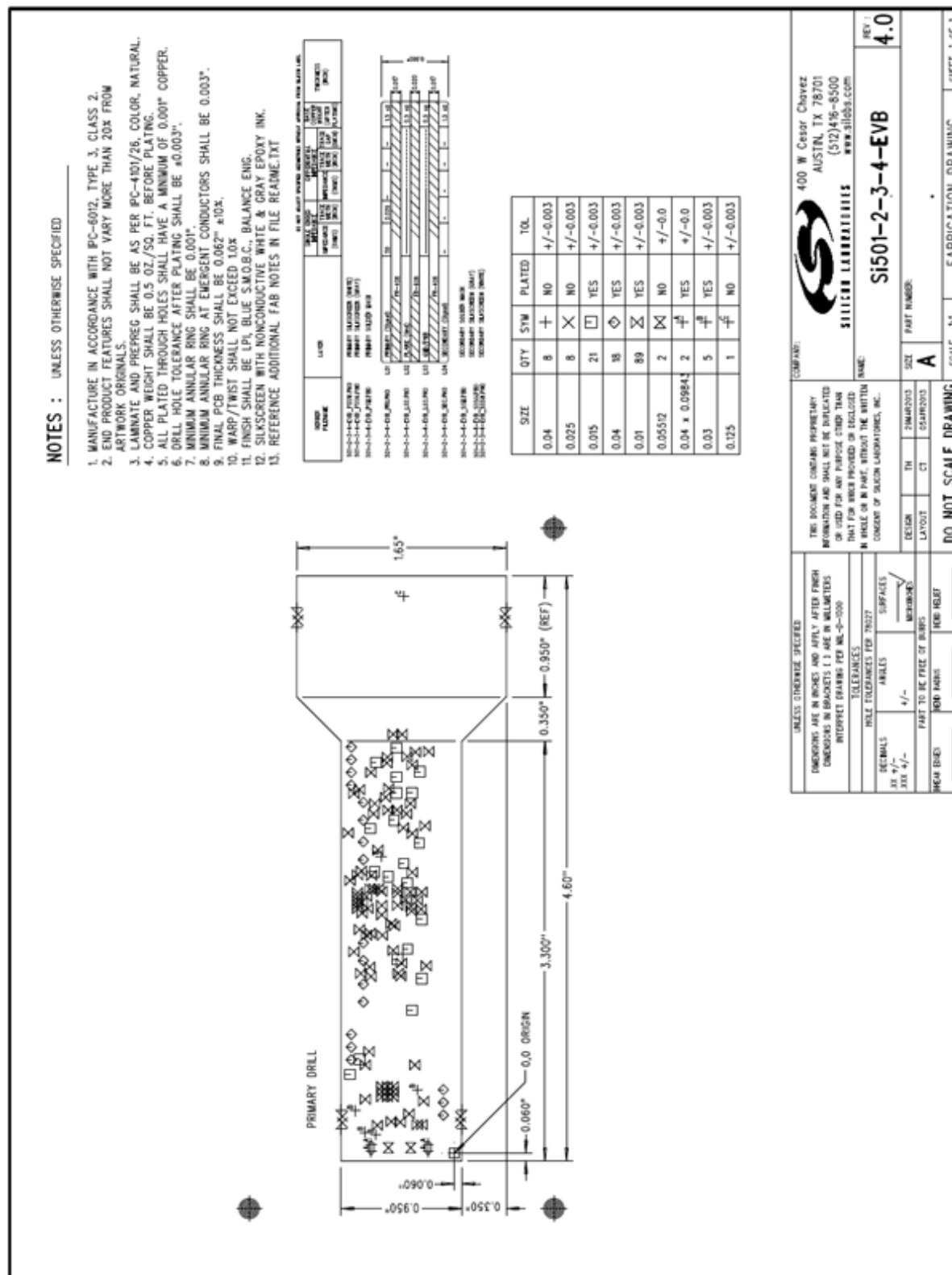


Figure 15. Rear Side

## 10. Fabrication Drawing



## CONTACT INFORMATION

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