# Si5xx/514/570-PROG-EVB

## Si514/570/571/598/599 Any-Frequency I²C Programmable XO/VCXO Evaluation Board

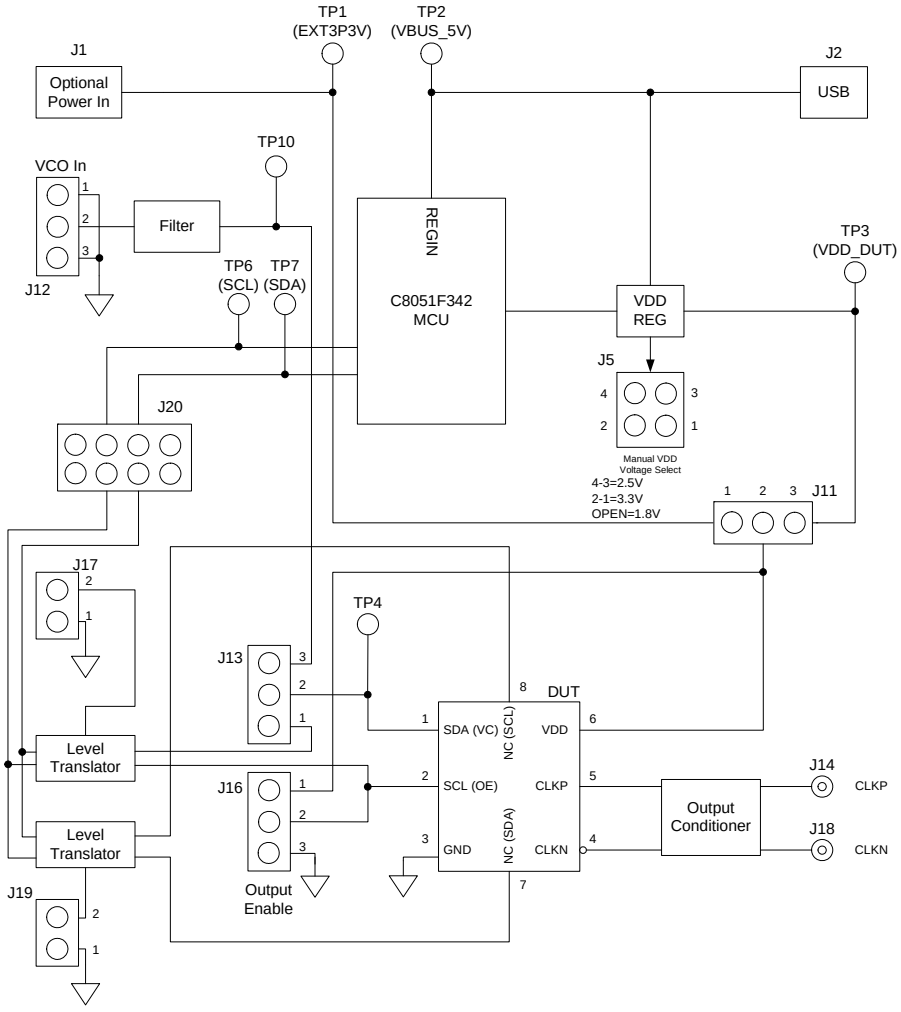
### Description

The Silicon Laboratories Si514/570/571/598/599 evaluation kit contains the hardware and software needed for evaluation of the Si514/570/571/598/599 Any-Frequency I²C programmable XO/VCXO and can be run on a USB-equipped PC.

### Features

- Evaluation of Silicon Laboratories' Si514/570/571/598/599 Any-Frequency I²C programmable XO/VCXO
- Windows-compatible software control and device programming
- Voltage regulator supports device operation of the Si5xx at +1.8, +2.5, or +3.3 V
- I²C communication options are jumper configurable
- Voltage control (VC) input port (Si571/Si599)

### Functional Block Diagram





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# 1. Introduction

This document describes the operation of the Silicon Laboratories Si514/570/571/598/599 evaluation kit. The Si5xx-PROG-EVB kit refers to the evaluation board hardware and software intended for customer evaluation of the Si514/570/571/598/599 Any-Frequency $I^2C$ programmable XO/VCXO. The Si5xx-EVB kit contains the following:

- Si5xx-PROG-EVB Hardware
- Programmable Oscillator Software
- EVB Driver (USBXpress®)

The software components run on a USB-equipped PC and are described in detail in Section “5. Software Guide”

The Si5xx-PROG-EVB evaluation board can be used to evaluate the Si514, Si570, Si571, Si598, and Si599 $I^2C$ programmable XOs or VCXOs as shown in Table 1. The Si514-PROG-EVB evaluation board can be used to evaluate the Si514 $I^2C$-programmable XO as shown in Table 1. This evaluation board functions and performs similar to the Si5xx-PROG-EVB evaluation board.

**Table 1. Si5xx XO and VCXO Device Evaluation Board Selector Guide**

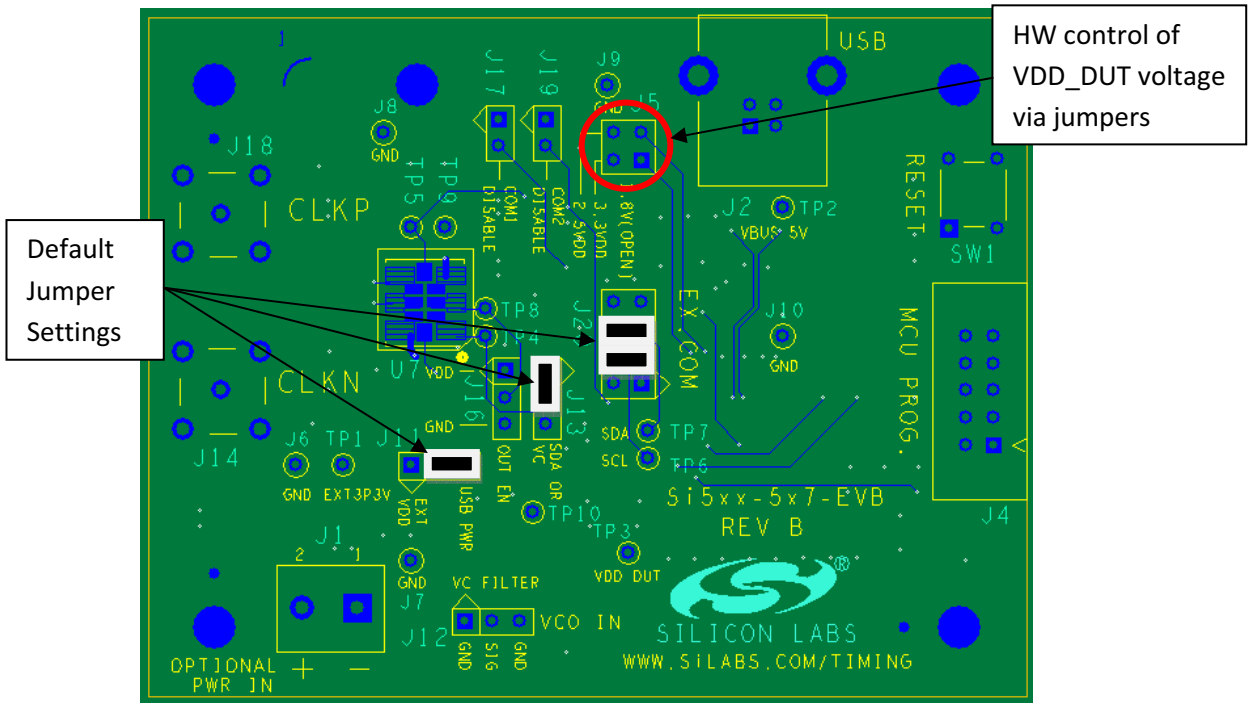
| Ordering Part # | Type | Devices Supported | Packages Supported | Output Format, Temp Stability, Tuning Slope | Supported Frequency Range |
|---|---|---|---|---|---|
| Si5xx-EVB | Single/Dual Frequency XO/VCXO Eval Board | Si510/511<br>Si512/513<br>Si515/516<br>Si530/531<br>Si532/533<br>Si550/552<br>Si590/591 | 5 x 7 mm, 6-pin<br>3.2 x 5 mm, 6-pin<br>3.2 x 5 mm, 4-pin | Any | 100 kHz to 1417 MHz |
| Si5xx-PROG-EVB | $I^2C$ Programmable XO/VCXO Eval Board | Si514<br>Si570/571<br>Si598/599 | 5 x 7 mm, 8-pin<br>5 x 7 mm 6-pin<br>3.2 x 5 mm, 6-pin | Any | 100 kHz to 1417 MHz |
| Si514-PROG-EVB | $I^2C$ Programmable XO Eval Board with soldered Si514 | Si514 | 5 x 7 mm 6-pin | Any | 100 kHz to 250 MHz |
| Si5xx5x7-EVB | Quad Frequency XO/VCXO Eval Board | Si534<br>Si554 | 5 x 7 mm, 8-pin | Any | 10 to 1417 MHz |
| Si570-PROG-EVB | $I^2C$ Programmable XO Eval Board with soldered Si570 | Si570 | 5x7 mm 8-pin | Any | 10 to 1417 MHz |

**Notes:**
1. Si5xx samples must be ordered separately from the Si5xx-PROG-EVB.
2. Board *must be* modified to be consistent with the ordered part. See "3.10. Output Terminations" on page 8.
3. Si514-PROG-EVB comes with an Si514 preinstalled.

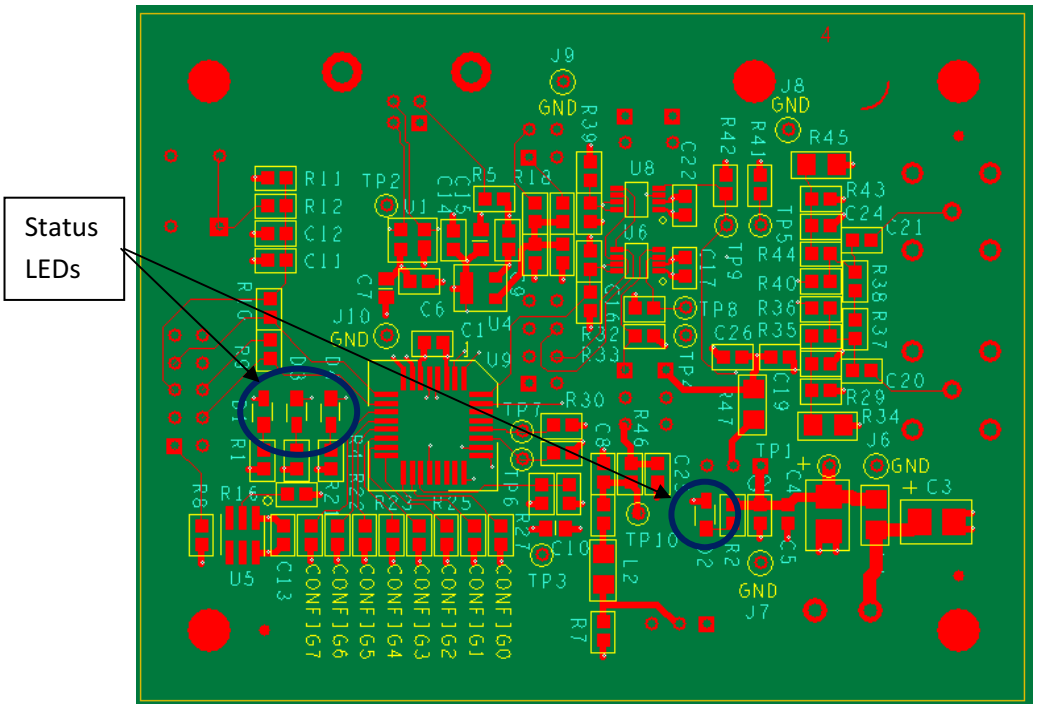
## 1.1. Quick Start

1. Install an Si514, Si570, Si571, Si598, or Si599 device on the board (Si514-PROG-EVB comes with an Si514 preinstalled; the Si570-PROG-EVB also comes with an Si570 installed).
2. Verify that the jumper settings are correct.
3. Connect the USB cable from the EVB to the host PC.
4. Install the Programmable Oscillator Software and driver.
5. Launch the Programmable Oscillator Software by clicking Start → Programs → Silicon Laboratories → Programmable Oscillator Software. Click on one of the shortcuts in the group.

## 2. Top/Bottom Views of Board




(a)




(b)

**Figure 1. Board Views (a) Top; (b) Bottom**

# 3. Functional Description

The Si5xx-PROG-EVB is the evaluation board assembly for the Si514/570/571/598/599 Any-Frequency $I^2C$ Programmable XO/VCO. This evaluation board assembly provides access to all signals for programming and operating the device. The Si5xx-PROG-EVB schematics, bill of materials, and PCB layouts are included as sections 6, 7, and 8, respectively. Figure 2 provides a block diagram for the board.

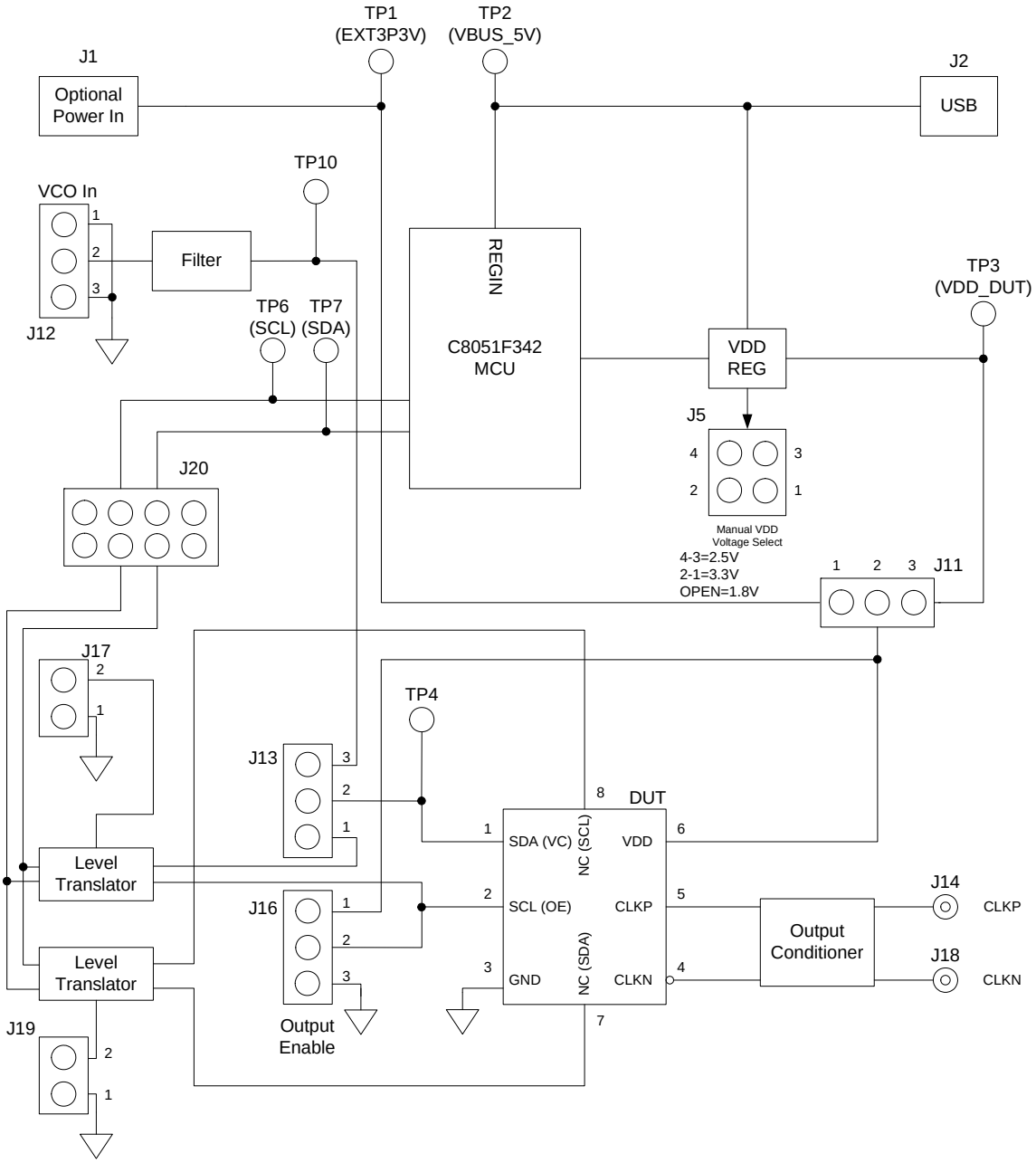



**Figure 2. Si5xx-PROG-EVB Functional Block Diagram**

## 3.1. Power Supply

The Si5xx-PROG-EVB is pre-configured to accept 5 V from the USB connector at J2. The DUT is powered from the VDD regulator by default, but could be changed to an external supply introduced through J1. To do this, simply move jumper J11 from pins 2-3 to 1-2 and apply power to J1. (Ensure the voltage range of the DUT is obeyed, and it is also good practice to set a current limit on the power supply).

It is also possible for the microcontroller (U9) to adjust the VDD regulator through the software. The microcontroller has pull-downs configured at P0.0 and P0.1 that grounds R18 and R19, respectively, adjusting VDD_DUT to 1.8, 2.5, or 3.3 V. It is also possible to install jumpers in J5 to manually force a VDD_DUT voltage. Table 2 illustrates the settings of J5:

**Table 2. J5 settings for VDD_DUT**

| Jumper | VDD_DUT |
|---|---|
| Open | 1.8 V |
| 1–2 | 3.3 V |
| 3–4 | 2.5 V |

## 3.2. Reset Circuit

The Si5xx-PROG-EVB MCU may be reset by momentarily pressing pushbutton SW1.

## 3.3. USB

A 4-pin USB receptacle is provided at location J2. The Si5xx-PROG-EVB is compatible with USB Specification 2.0. When the USB link is in use, the MCU drives LED D4.

## 3.4. MCU

The Silicon Laboratories MCU, P/N C8051F342, provides the following functions:

- Supports $I^2C$ communication to the DUT on behalf of the host PC per the Programmable Oscillator Software
- Drives a number of status indicator LEDs (see Table 3)
- Supplies 3.3 V to peripheral ICs on the motherboard but not to the DUT
- Controls DUT power (see Section “3.1. Power Supply” )
- Auto-detects the part type (e.g., Si51x/Si57x/Si59x)

There is a provision for in-circuit programming at connector J4. This provision should not be needed in normal operation. The host PC operates the software and communicates to the Si5xx-PROG-EVB through the MCU via USB connector J2. When the USB link is in use, LED D4 should flash. The MCU may be reset by momentarily pressing pushbutton (SW1).

## 3.5. Status Signals

There are four LEDs on the Si5xxPROG-EVB that report visual status as listed in Table 3 and shown in Figure 1b. Upon powerup, D1 should be illuminated.

**Table 3. Si5xx-PROG-EVB LEDs**

| LED | ON | OFF |
|---|---|---|
| D1 | VDD3p3 volts is present | VDD3p3 volts is NOT present |
| D2 | Ext3p3V volts is present | Ext3p3V volts is NOT present |
| D3 | Reserved | Reserved |
| D4 | USB access in progress | No USB access in progress |

## 3.6. Jumpers

There are seven jumper locations on the Si5xx-PROG-EVB as listed in Table 4. The default or pre-loaded jumpers are shown in Figure 1a.

**Table 4. Si5xx-PROG-EVB Jumpers**

| Jumper Block Reference | Function |
|---|---|
| J5 | Manual (on-board) VDD_DUT adjust (see Table 1) |
| J11 | VDD_DUT select:<br>1-2: External voltage (from J1)<br>2-3: On-board regulator |
| J13 | $I^2C$/Vc selector:<br>1-2: $I^2C$ communication<br>3-4: Ext Vc input (Si57x) |
| J16 | Output enable (Si57x):<br>1-2: OE is HIGH<br>3-4: OE is LOW |
| J17 | Manual shutdown of $I^2C$ port for Si514 (also controllable via SW) |
| J19 | Manual shutdown of $I^2C$ port for Si57x (also controllable via SW) |
| J20 | $I^2C$ communication access port<br>3-4: SCL connection to MCU<br>5-6: SDA connection to MCU |

## 3.7. External I²C Communication

It is possible to use an external I²C controller to communicate with the DUT. To do this, remove the jumpers installed in J20 and connect the external I²C harness to J20. Grounded pins (1-2, 7-8) are there for grounding the harness. Pins 4 and 6 can be driven as SCL and SDA, respectively.

## 3.8. Si5xx-PROG-EVB Digital Control Signal

One normally static digital input control signal routes to the Si5xx: Output Enable or OE. By default, the OE signal is pulled HIGH on the Si5xx-PROG-EVB and may be pulled low by installing a jumper at J16.

## 3.9. Si5xx-PROG-EVB Voltage Control Signal

An external voltage control signal may be applied to the control voltage modulation input at the J12 header (VCO_IN). This voltage supplies the control voltage or voltage modulation input to the DUT. J13 should be installed in the 2-3 position.

## 3.10. Output Terminations

The Si5xx-PROG-EVB can support four different output formats: CMOS, LVPECL, LVDS, and HCSL. There are output resistors that are needed to accompany each format. Table 5 shows which resistors are needed for each output:

**Table 5. Output Termination Installation Definition**

| Output Format | R36 | R40 | R35 | R44 | R37 | R38 | R29 | R34 | R43 | R45 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CMOS** | 10 | 10 | NP | NP | NP | NP | NP | NP | NP | NP |
| **LVPECL** | 0 | 0 | 130 | 130 | NP | NP | NP | 0 | NP | 0 |
| **LVDS** | 0 | 0 | NP | NP | NP | NP | NP | NP | NP | NP |
| **HCSL** | 0 | 0 | NP | NP | NP | NP | NP | NP | NP | NP |

# 4. Configuring the Si5xx-PROG-EVB

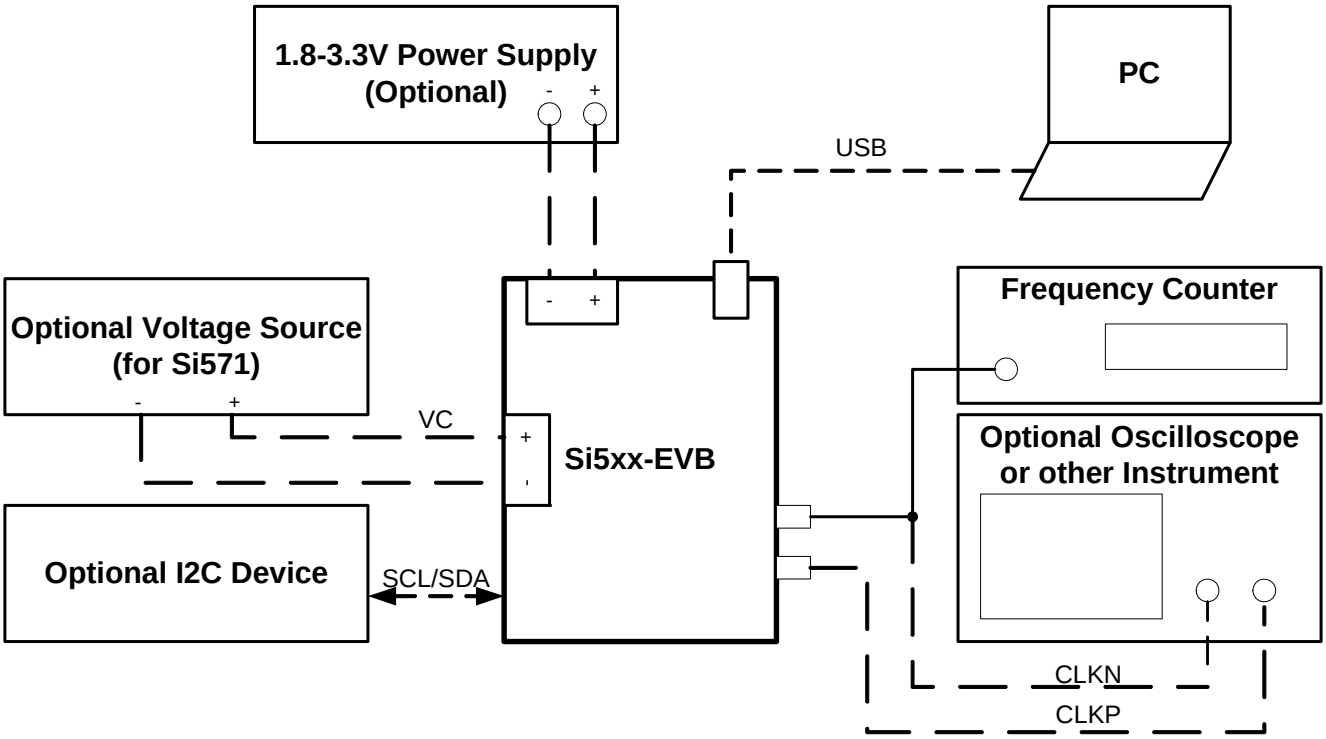



**Figure 3. Si5xx-PROG-EVB Typical Configuration**

# 5. Software Guide

The evaluation kit includes software called Programmable Oscillator Software, which consists of several tools:

- **Programmable Oscillator Calculator**—Program new dividers and output frequencies in the device using large and small frequency programming procedures. This can run with or without an EVB connected to the computer.
- **Register Programmer**—Program individual registers on the oscillator device on the EVB.
- **Si57x/9x Register Programmer**—Program Si570/571/598/599 specific registers.
- **Register Viewer**—View all the register values on the oscillator installed on the EVB.
- **User Guide**—Read more help information on using the software.
- **Spreadsheet Finder for HS_DIV and N1**—Use an Excel spreadsheet to find the Si570/571/598/599 dividers. No EVB is required.

## 5.1. Programmable Oscillator Software Installation

The following sections describe how to install and use the software. There is a readme.txt file with the installation files as well as a software user guide installed with the software.

## 5.2. System Requirements

- Microsoft Windows® 2000, XP, Vista, 7
- USB 2.0
- 2 MB of free hard drive space
- 1024 x 768 screen resolution or greater
- Microsoft .NET Framework 1.1
- USBXpress 3.1.1 driver

**Note:** USBXpress 3.1.1 driver is provided and installed with the software. Newer or older versions of USBXpress available from other EVB kits or online have not been tested with this software.

## 5.3. Microsoft .NET Framework Installation

The Microsoft .NET Framework is required before installing and running the software. Details and installation information about the .NET Framework are available via a shortcut in the NETFramework directory or at the following web site:

www.microsoft.com/downloads/details.aspx?FamilyId=262D25E3-F589-4842-8157-034D1E7CF3A3&displaylang=en

There are multiple versions of the .NET Framework available from Microsoft, and they can be installed side-by-side on the same computer. The software requires Version 1.1 but can run under other versions. Contact your system administrator for more details.

## 5.4. Programmable Oscillator Software Installation

The Programmable Oscillator Software is installed from the ProgOscSwInstall.exe file.

1. Double-click the install file to start the wizard.
2. Follow the wizard instructions to complete the installation for both the software and the driver. Use the default installation location for best results.
3. After the installation is complete, click on Start → Programs → Silicon Laboratories → Programmable Oscillator Software. Select one of the items in the menu including the User Guide to get more details on how to run the software.

## 5.5. Programmable Oscillator Software Uninstall

Close all the programs and help files before running the uninstaller to ensure complete removal of the software. To uninstall the software, use the Add and Remove Programs utility in the Control Panel or click Start → Programs → Silicon Laboratories → Programmable Oscillator Software → Uninstaller.

**Note:** The driver software must be uninstalled separately.

# 6. Schematic

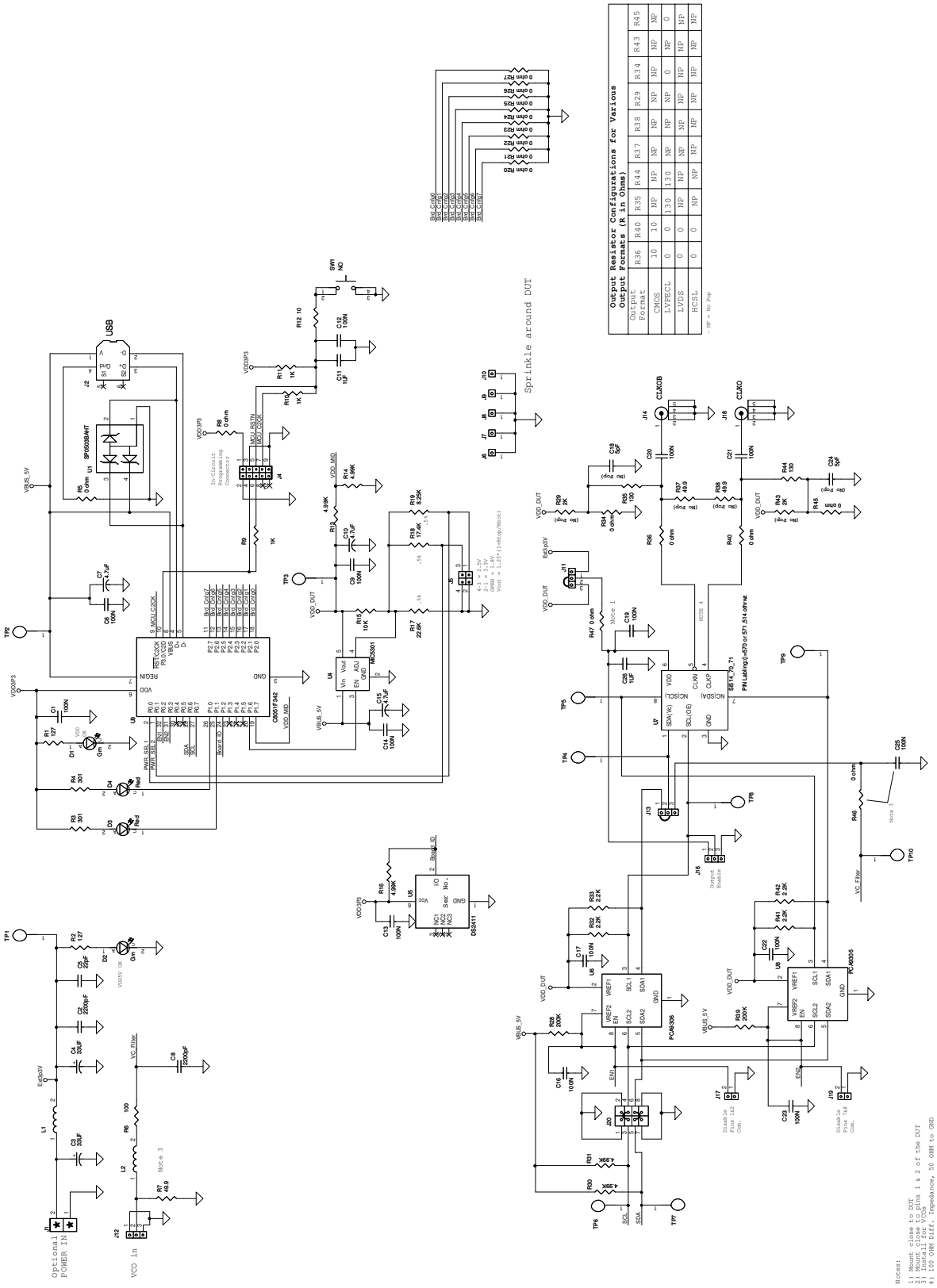



**Figure 4. Si5xx-PROG-EVB (Universal I²C XO/VCXO)**

# 7. Bill of Materials

**Table 6. Si5xx-PROG-EVB/Si514-PROG-EVB/Si570-PROG-EVB Bill of Materials[1]**

| Item | Qty | Reference | Value | Mfr | Manufacturer PN | PCB Footprint |
|---|---|---|---|---|---|---|
| 1 | 14 | C1,C6,C9, C12,C13, C14,C16, C17,C19, C20,C21, C22,C23, C25 | 100 nF | Venkel | C0603X7R160-104KNE | SM_C_0603 |
| 2 | 2 | C2,C8 | 2200 pF | Venkel | C0603X7R160-222KNE | SM_C_0603 |
| 3 | 2 | C3,C4 | 33 µF | Venkel | TA006TCM336KBR | EIA 3528 |
| 4 | 1 | C5 | 22 pF | Venkel | C0603C0G500-220KNE | SM_C_0603 |
| 5 | 3 | C7,C10,C15 | 4.7 µF | Venkel | C0805X5R6R3-475KNE | SM_C_0805 |
| 6 | 2 | C11,C26 | 1 µF | Venkel | C0603X7R6R3-105KNE | SM_C_0603 |
| 7 | 2 | D1,D2 | Grn | Panasonic | LN1371G | LED_gull |
| 8 | 2 | D3,D4 | Red | Lumex | LN1271RAL | LED_gull |
| 9 | 1 | J1 | Phoenix_2_screw | Phoenix | MKDSN 1.5/2-5.08 | Phoenix2pin-M_p2pitch |
| 10 | 1 | J2 | USB | FCI | 61729-0010BLF | USB_typeB |
| 11 | 1 | J4 | 5by2_Shrd_Hdr_SMT | Sullins | PPTC052LJBN-RC | 5by2header_thruhole |
| 12 | 1 | J5 | 2by2_M_Hdr | Sullins | PBC36DAAN | 2by2header_p1pitch |
| 13 | 5 | J6,J7,J8,J9, J10 | Jmpr_1pin | Tyco | 87224-1 | 1by1header_TH |
| 14 | 4 | J11,J12,J13, J16 | Jmpr_3pin | Tyco | 146225-3 | 3pin_p1pitch |
| 15 | 2 | J14,J18 | SMA_VERT | Johnson | 142-0701-211 | SMA_VERT |
| 16 | 2 | J17,J19 | Jmpr_2pin | Sullins | PBC36DAAN | 2by2header_p1pitch |
| 17 | 1 | J20 | 4X2 Header | Sullins | PBC04DFAN | 4by2header_p1pitch |

**Notes:**
1. Outputs configured for LVPECL.
2. Si514-PROG-EVB contains a presoldered 514CBA000118AAG device.
3. Si570-PROG-EVB contains a presoldered 570ACA000118DG.

**Table 6. Si5xx-PROG-EVB/Si514-PROG-EVB/Si570-PROG-EVB Bill of Materials[1] (Continued)**

| Item | Qty | Reference | Value | Mfr | Manufacturer PN | PCB Footprint |
|---|---|---|---|---|---|---|
| 18 | 2 | L1,L2 | Ferrite | Murata | BLM31A601S | 1206 |
| 19 | 2 | R1, R2 | 127 Ω | Venkel | CR0603-16W-1270FT | SM_R_0603 |
| 20 | 3 | R3,R4 | 301 Ω | Venkel | CR0603-16W-3010FT | SM_R_0603 |
| 21 | 16 | R5,R8,R20, R21,R22, R23,R24, R25,R26, R27,R34, R36,R40, R45,R46, R47 | 0 Ω | Venkel | CR0603-16W-000T | SM_R_0603 |
| 22 | 1 | R6 | 100 Ω | Venkel | CR0603-16W-1000FT | SM_R_0603 |
| 23 | 1 | R7 | 49.9 Ω | Venkel | CR0603-16W-49R9FT | SM_R_0603 |
| 24 | 3 | R9,R10,R11 | 1 kΩ | Venkel | CR0603-16W-1001FT | SM_R_0603 |
| 25 | 1 | R12 | 10 Ω | Venkel | CR0603-16W-10R0FT | SM_R_0603 |
| 26 | 1 | R15 | 10 kΩ | Venkel | CR603-16W-1002FT | SM_R_0603 |
| 27 | 5 | R13,R14, R16,R30, R31 | 4.99 kΩ | Venkel | CR0603-16W-4991FT | SM_R_0603 |
| 28 | 1 | R17 | 22.6 kΩ | Venkel | CR0603-16W-2262FT | SM_R_0603 |
| 29 | 1 | R18 | 17.4 kΩ | Venkel | CR0603-16W-1742FT | SM_R_0603 |
| 30 | 1 | R19 | 8.25 kΩ | Venkel | CR0603-16W-8251FT | SM_R_0603 |
| 31 | 2 | R28,R39 | 200 kΩ | Venkel | CR0603-16W-2003FT | SM_R_0603 |
| 32 | 4 | R32,R33,R41,R42 | 2.2 kΩ | Venkel | CR0603-16W-2201FT | SM_R_0603 |
| 33 | 2 | R35,R44 | 130 Ω | Venkel | CR0603-16W-1300FT | SM_R_0603 |
| 34 | 1 | SW1 | NO | Mountain Switch | 101-0161-EV | 4pinSwitch |
| 35 | 2 | TP1,TP10 | Test Point | Key Stone | 5001K | .035" TH |
| 36 | 1 | U1 | SP0503BAHT | Little Fuse | SP0503BAHT | SOT143 |
| 37 | 1 | U4 | MIC5301 | Micrel | MIC5301YD5 | SOT23-5 |

**Notes:**
1. Outputs configured for LVPECL.
2. Si514-PROG-EVB contains a presoldered 514CBA000118AAG device.
3. Si570-PROG-EVB contains a presoldered 570ACA000118DG.

**Table 6. Si5xx-PROG-EVB/Si514-PROG-EVB/Si570-PROG-EVB Bill of Materials[1] (Continued)**

| Item | Qty | Reference | Value | Mfr | Manufacturer PN | PCB Footprint |
|---|---|---|---|---|---|---|
| 38 | 1 | U5 | DS2411 | Maxim/ Dallas | DS2411RP+ | TSOC-6 |
| 39 | 2 | U6,U8 | PCA9306 | TI | PCA9306DCTR | PSOP |
| 40 | 1 | U9 | C8051F342 | Silicon Labs | C8051F342-GQ | LQFP-32 |
| **Not Populated** | | | | | | |
| 41[2] | | U7 | Si514_70_71 | Silabs | | |
| 42 | | R29,R43 | 2 kΩ | Venkel | CR0603-16W-2001FT | SM_R_0603 |
| 43 | | C18,C24 | 5 pF | Venkel | C0603X7R160-104KNE | SM_C_0603 |
| 44 | | R37,R38 | 49.9 Ω | Venkel | CR0603-16W-49R9FT | SM_R_0603 |
| 45 | | TP2,TP3, TP4,TP5, TP6,TP7, TP8,TP9 | Test Point | Key Stone | 5001K | .035" TH |

**Notes:**
1. Outputs configured for LVPECL.
2. Si514-PROG-EVB contains a presoldered 514CBA000118AAG device.
3. Si570-PROG-EVB contains a presoldered 570ACA000118DG.

| | |
|---|---|
| Part Order Code | 514CBA000118AAG |
| Type | $I^2C$ Programmable |
| Package | 5x7 mm, 6-Pin |
| Output | CMOS |
| Frequency Range | 0.10–212.5 MHz |
| Starting Frequency | 156.25 MHz |
| VDD | 3.3 V |
| Temperature Stability | ±25 ppm |
| Total Stability | ±50 ppm |
| Opening Temperature Range | –40 to 85 °C |
| Data Sheet | http://www.silabs.com/support%20documents/technicaldocs/si514.pdf |

| | |
|---|---|
| Part Order Code | 570ACA000118DG |
| Type | $I^2C$ programmable |
| Package | 5x7 mm, 8 pin |
| Output | LVPECL |
| Frequency Range | 10–945, 970–1134, 1213–1417.5 MHz |
| Starting Frequency | 156.25 MHz<br>VDD: 3.3 V |
| VDD | 3.3 V |
| Total Stability | 20 ppm |
| Opening Temperature Range | –40 to 85 °C |
| Data Sheet | http://www.silabs.com/support%20documents/technicaldocs/si570.pdf |

# 8. Layout

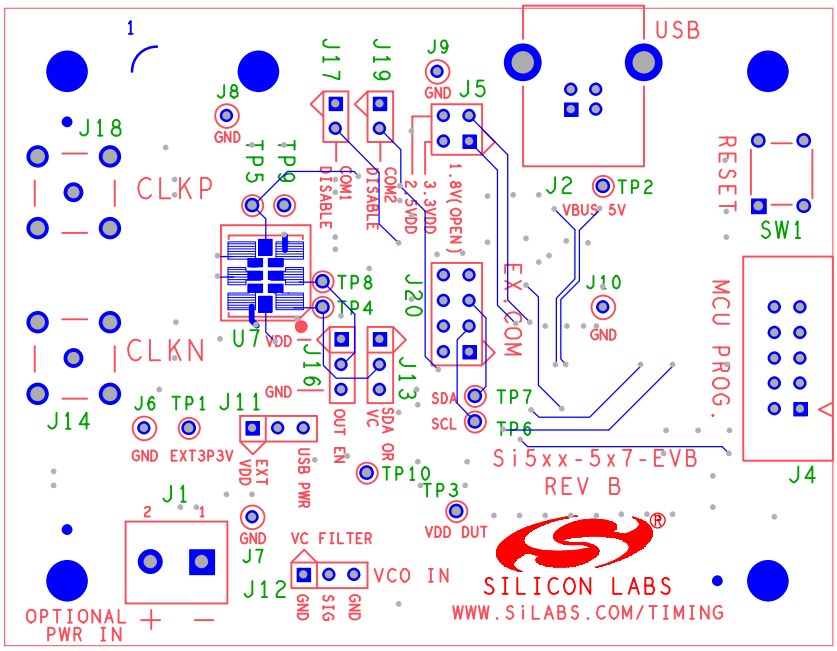



**Figure 5. Primary Side**

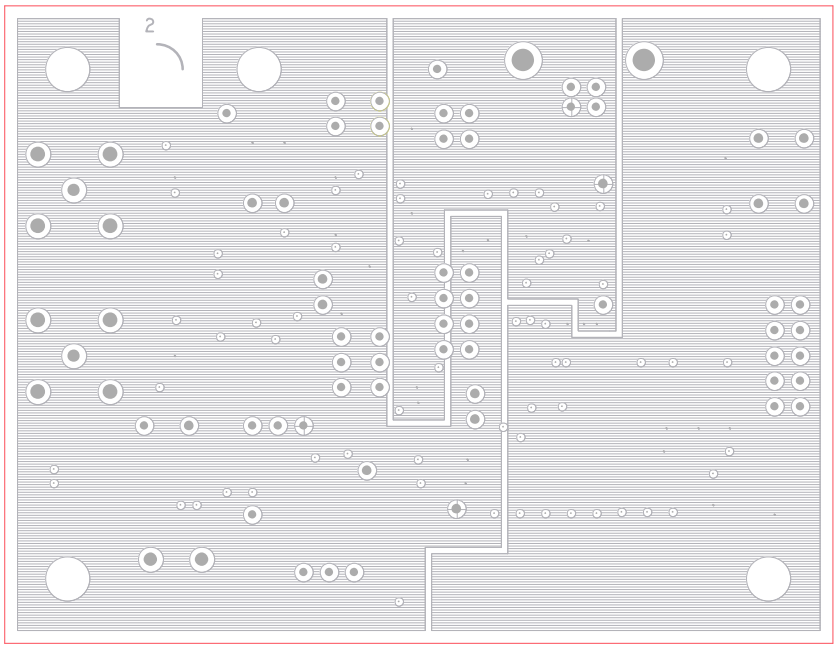



**Figure 6. Layer 2: PWR**

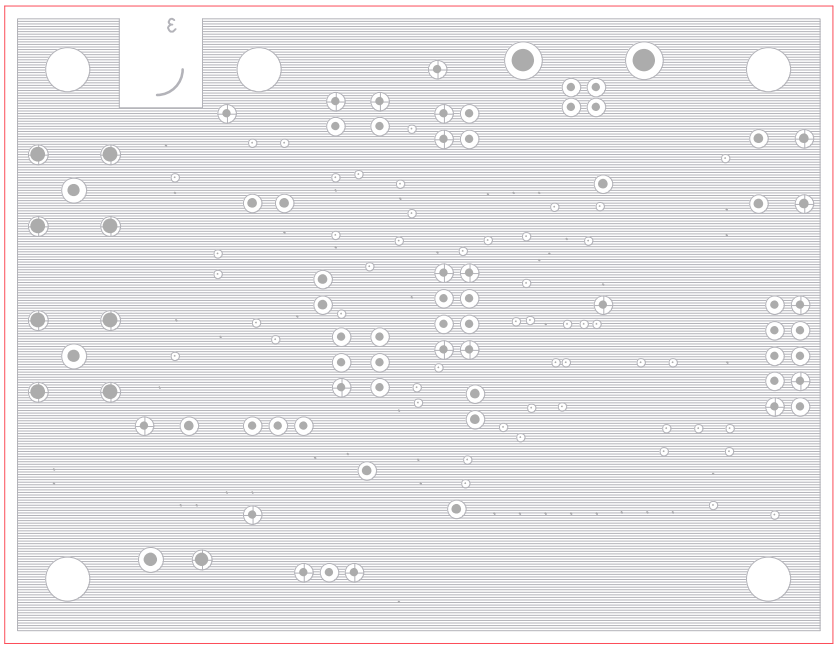


**Figure 7. Layer 3: GND**

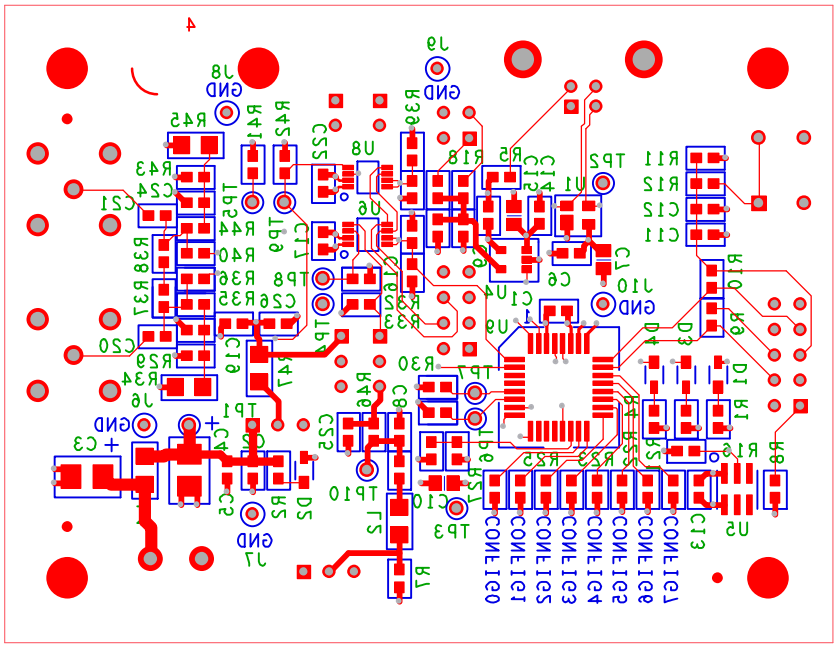


**Figure 8. Secondary Side**

# DOCUMENT CHANGE LIST

## Revision 0.1 to Revision 0.2

- Added ordering information and revised text to add the Si514-PROG-EVB to the list of released EVBs.
- Updated Table 5 on page 8.
- Updated Figure 4 on page 11 (schematic).
- Updated "7. Bill of Materials" on page 12 and notes.
  - Described changes needed for the Si514-PROG-EVB.

## Revision 0.2 to 0.3

- Added ordering information and revised test for the newly released Si570-PROG-EVB

## NOTES:

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Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
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- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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