Si5xx/514/570-PROG-EVB

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

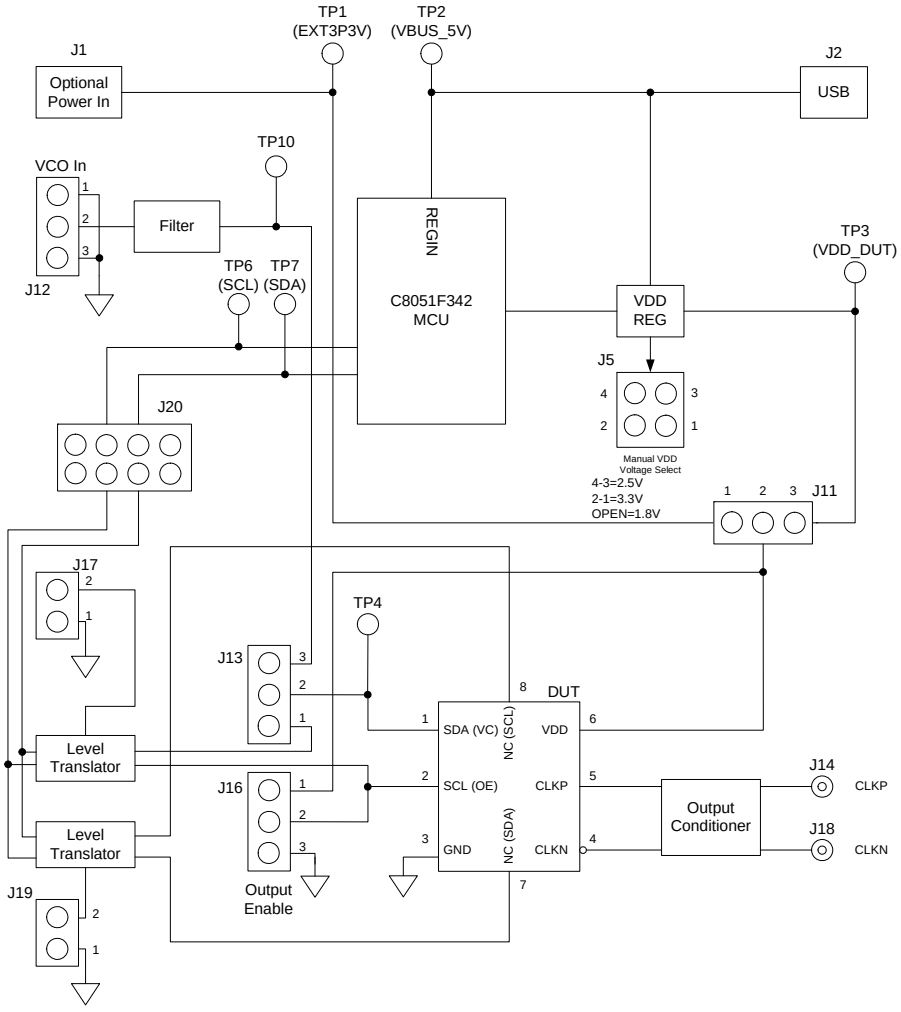
Description

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

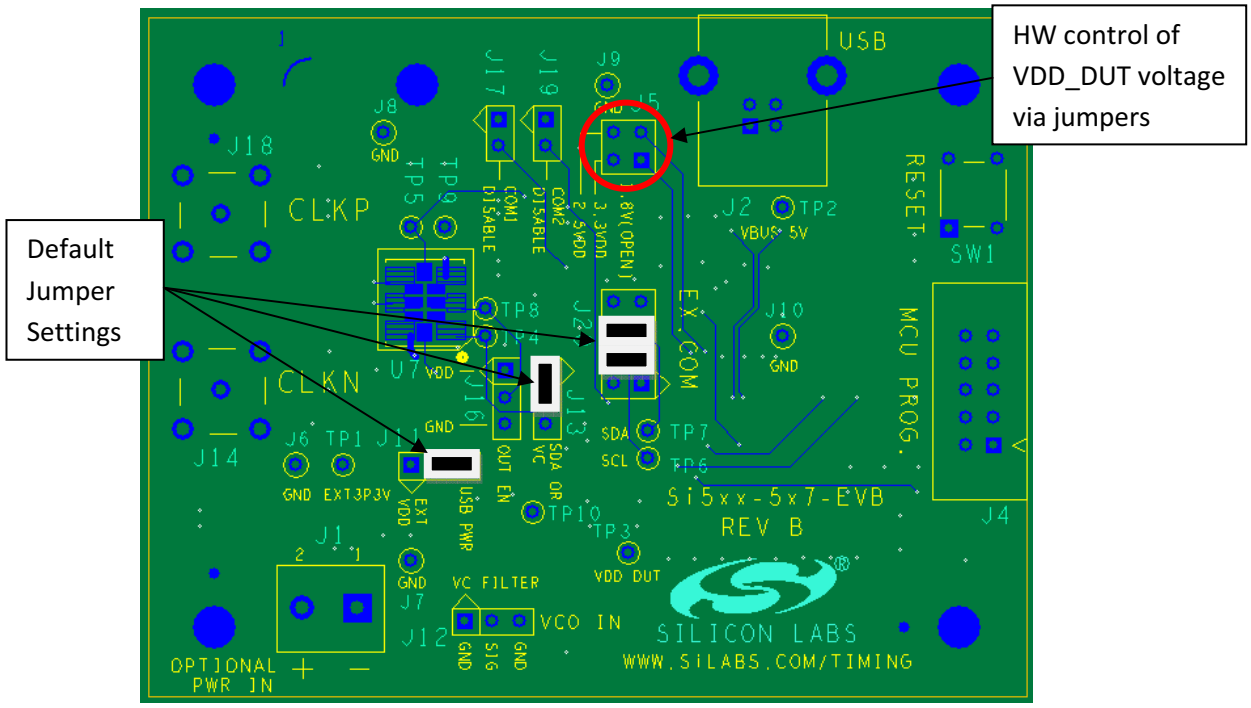
Ordering Part #	Type	Devices Supported	Packages Supported	Output Format, Temp Stability, Tuning Slope	Supported Frequency Range
Si5xx-EVB	Single/Dual Frequency XO/VCXO Eval Board	Si510/511 Si512/513 Si515/516 Si530/531 Si532/533 Si550/552 Si590/591	5 x 7 mm, 6-pin 3.2 x 5 mm, 6-pin 3.2 x 5 mm, 4-pin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

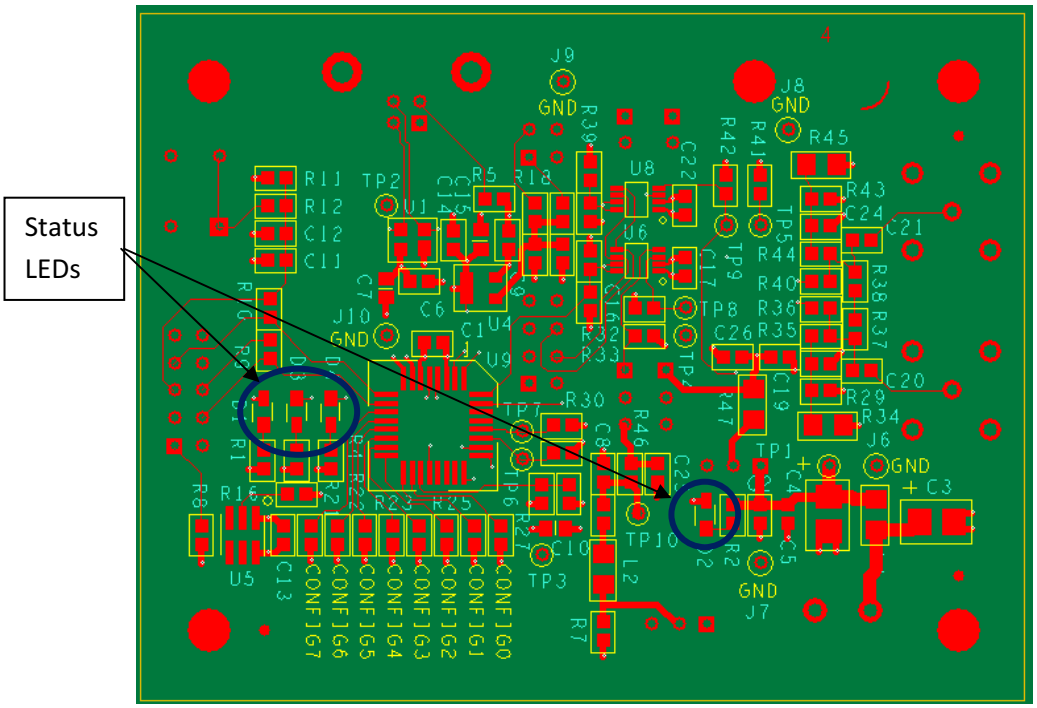
1.1. Quick Start

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.

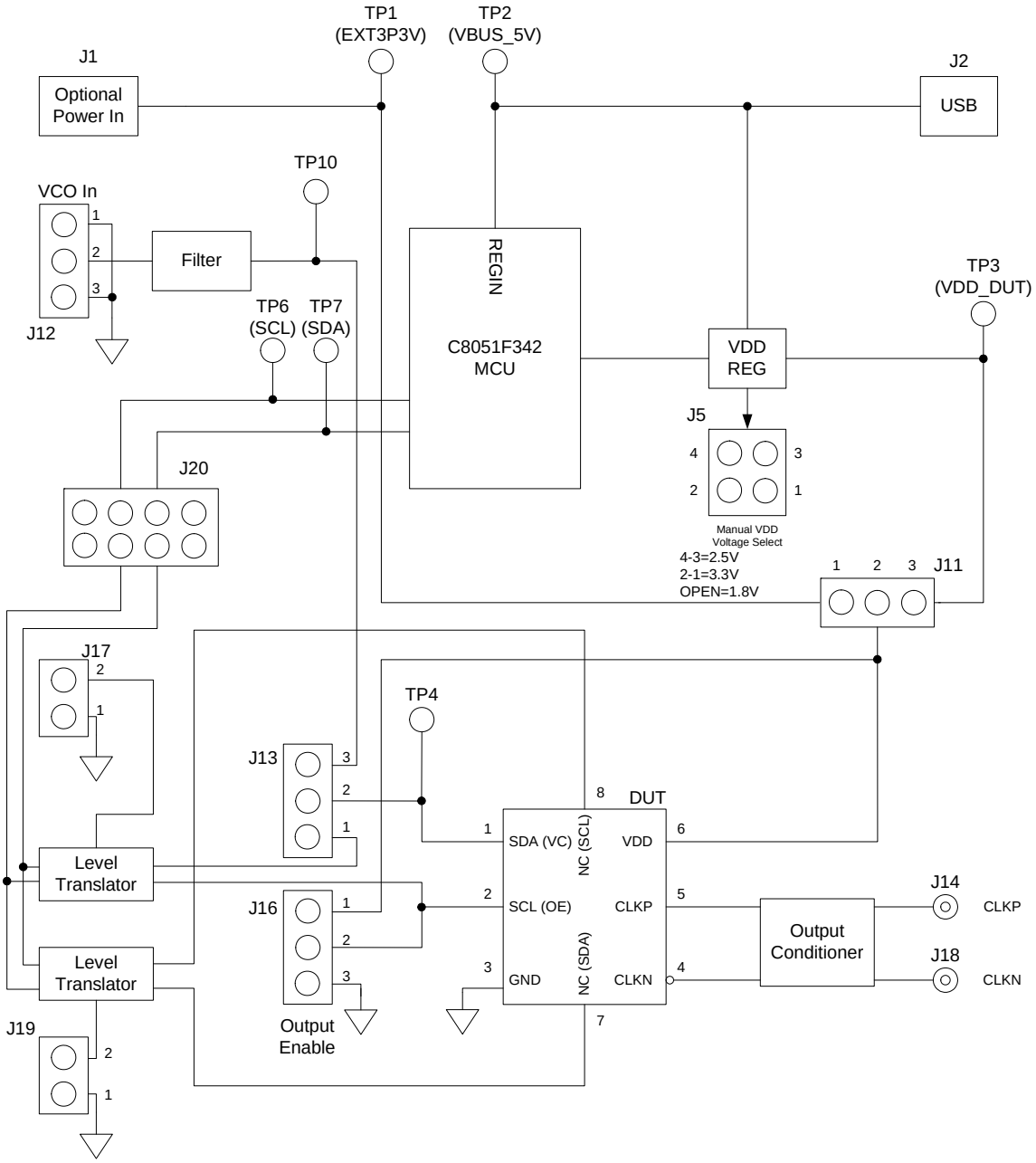


Figure 2. Si5xx-PROG-EVB Functional Block Diagram

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: 1-2: External voltage (from J1) 2-3: On-board regulator
J13	I^2C/Vc selector: 1-2: I^2C communication 3-4: Ext Vc input (Si57x)
J16	Output enable (Si57x): 1-2: OE is HIGH 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 3-4: SCL connection to MCU 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

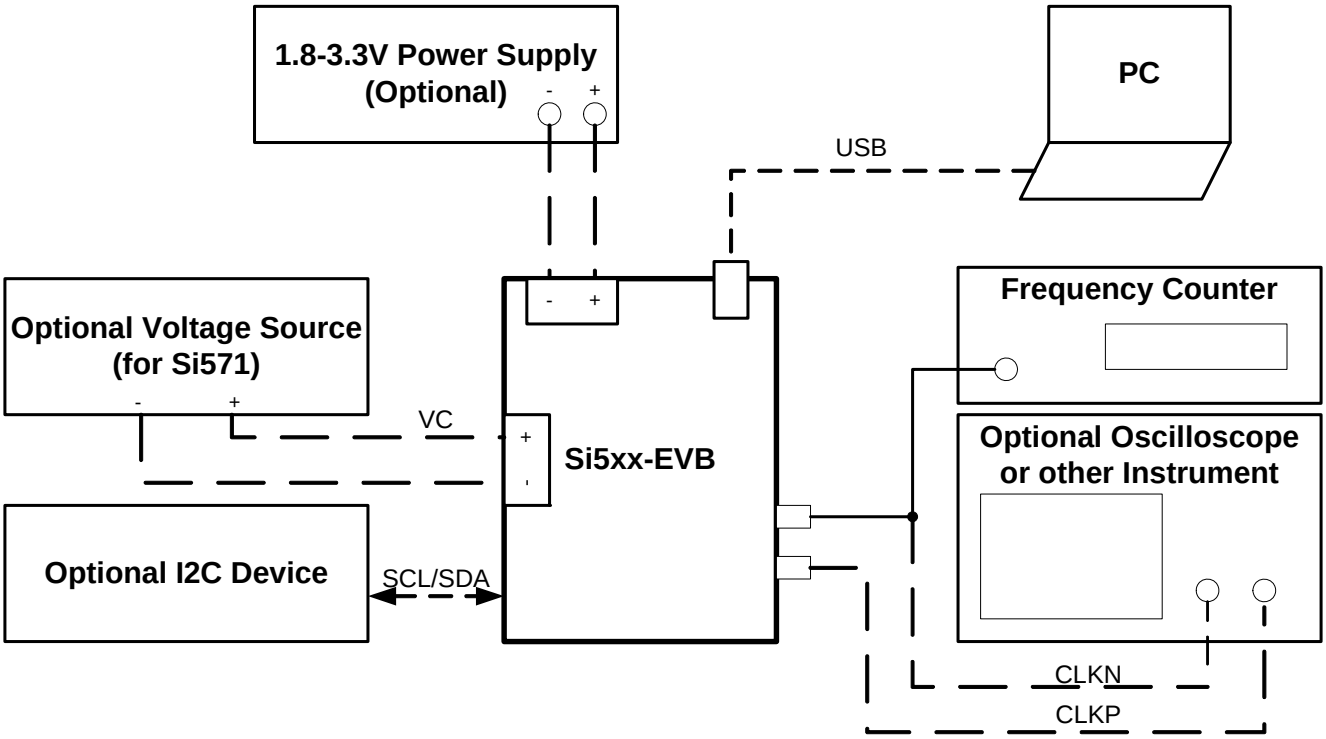


Figure 3. Si5xx-PROG-EVB Typical Configuration

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

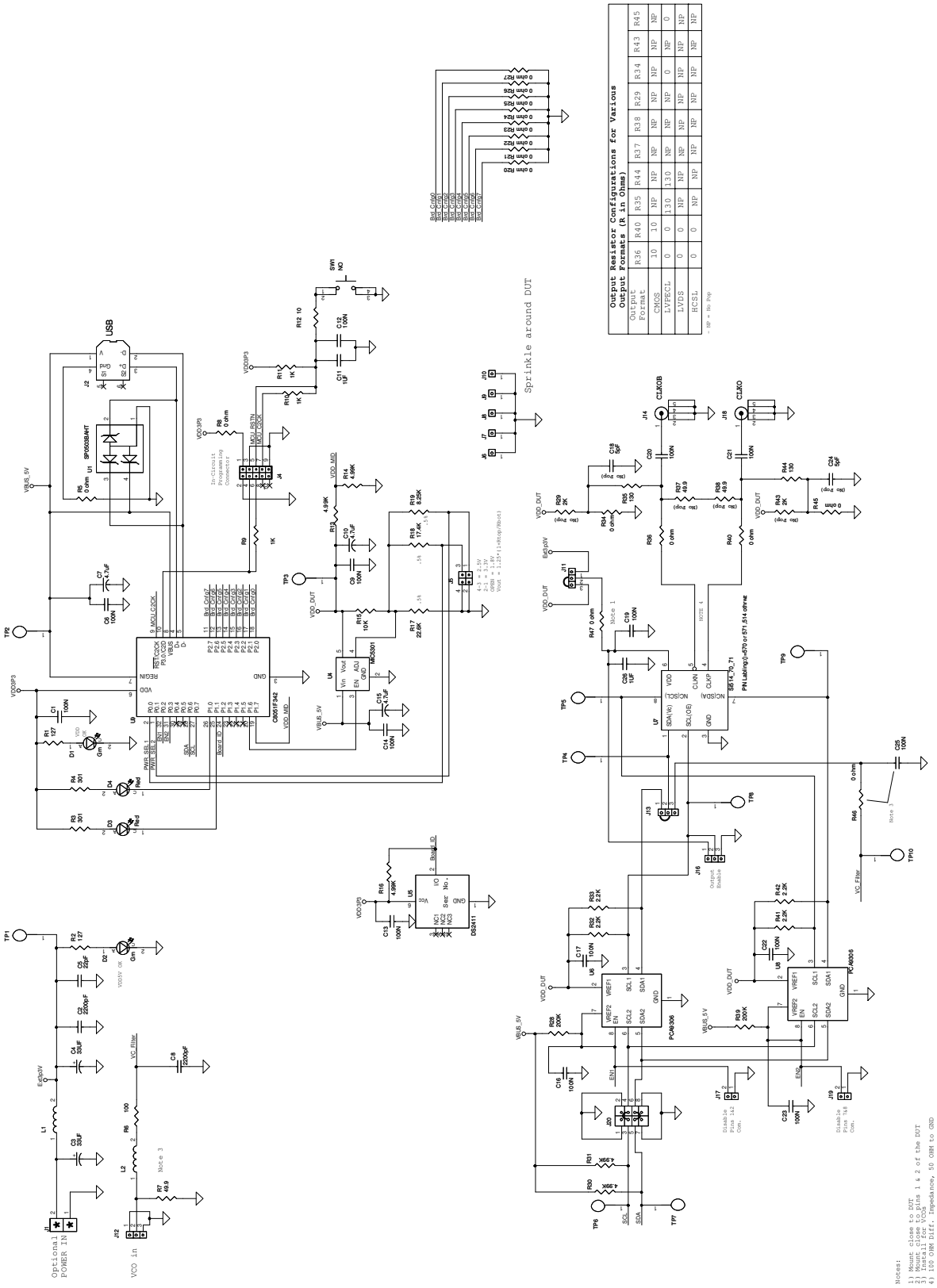


Figure 4. Si5xx-PROG-EVB (Universal I²C XO/VCXO)

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 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

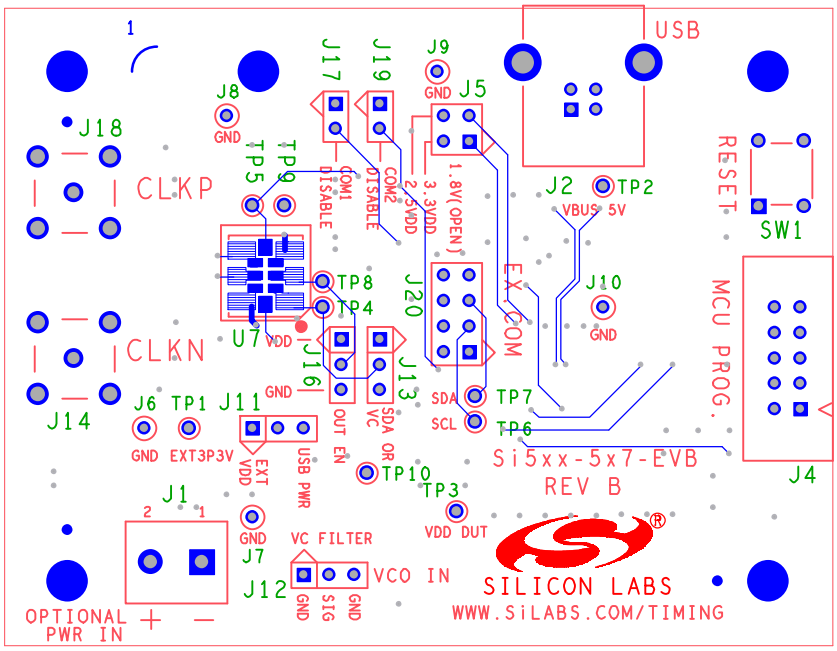


Figure 5. Primary Side

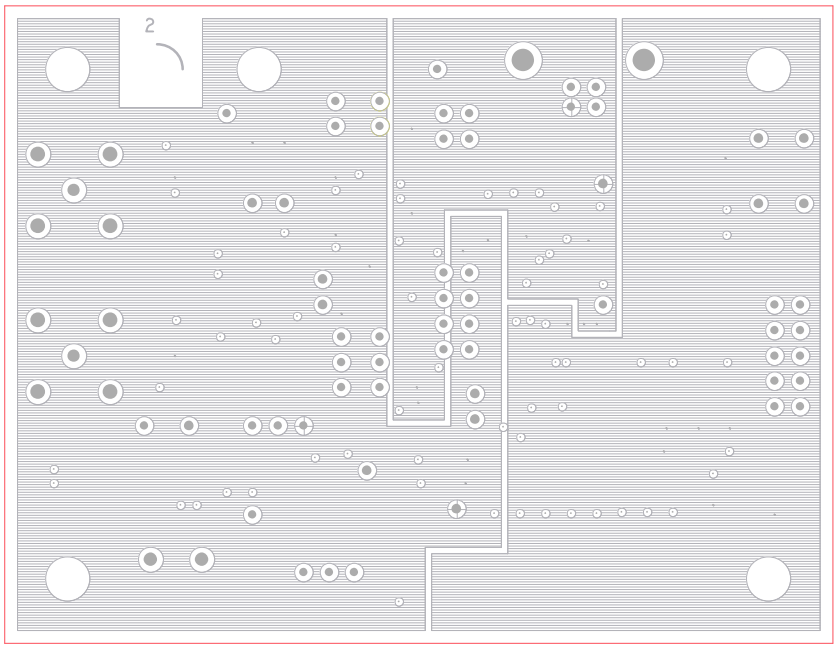


Figure 6. Layer 2: PWR

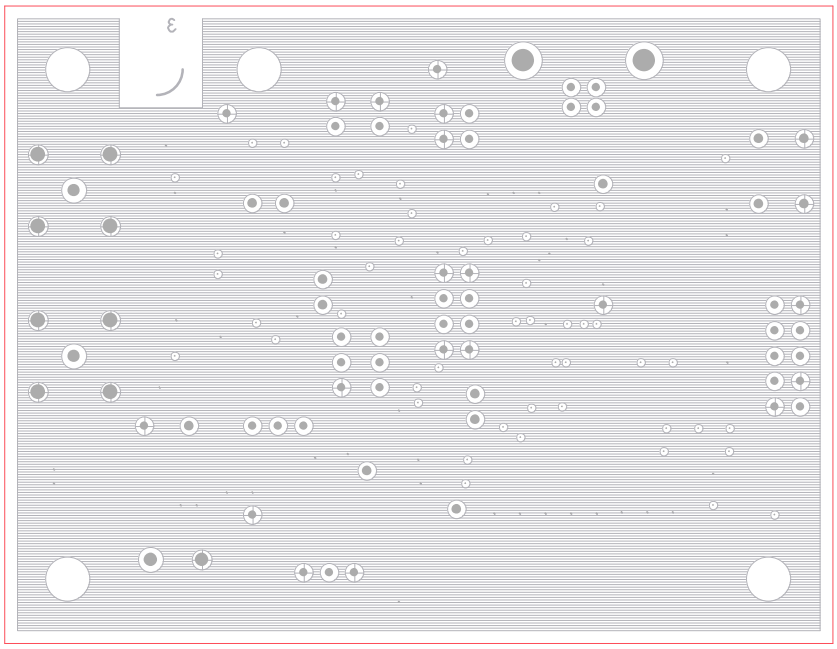


Figure 7. Layer 3: GND

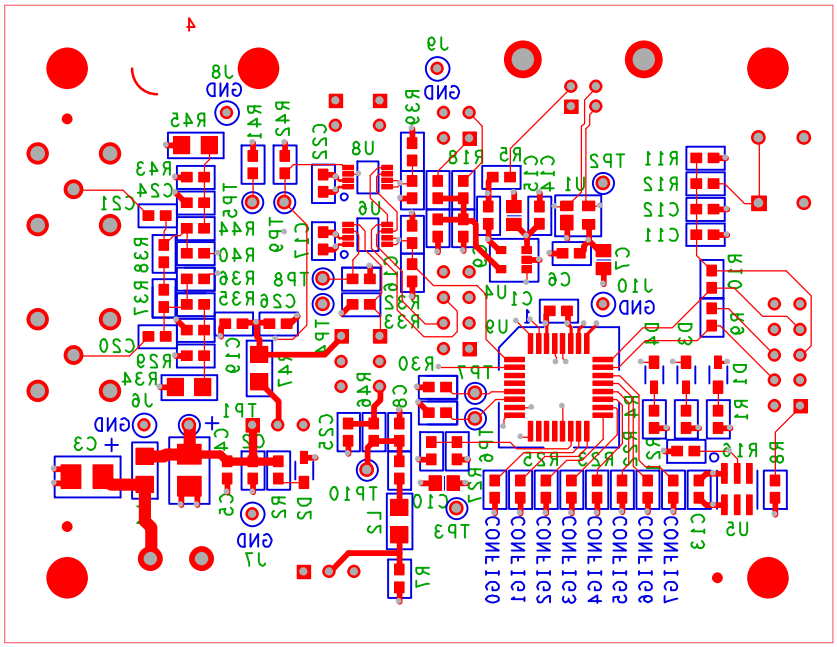


Figure 8. Secondary Side

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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- Экспресс доставка в любую точку России;
- 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.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

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«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

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«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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